

UNIVERSITY OF TORONTO



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WORLD'S COLUMBIAN EXPOSITION

1893

AT CHICAGO



MANUFACTURES AND TRADE

BY THE

DEPARTMENT OF TRADE AND MANUFACTURES

MINISTRY OF FINANCE

THE
INDUSTRIES OF RUSSIA



MANUFACTURES AND TRADE

WITH A GENERAL INDUSTRIAL MAP

BY THE

DEPARTMENT OF TRADE AND MANUFACTURES MINISTRY OF FINANCE

FOR THE

WORLD'S COLUMBIAN EXPOSITION

AT

CHICAGO

EDITOR OF THE ENGLISH TRANSLATION

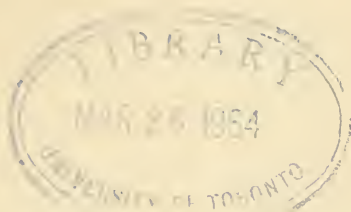
JOHN MARTIN CRAWFORD

U S CONSUL GENERAL TO RUSSIA

Vol I

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PREFACE.

In order to properly celebrate the 400th anniversary of the discovery of the New World, the Congress of the United States of America in session at Washington resolved to arrange an international competition in the peaceful arena of industry and trade, and for which purpose the World's Columbian Exposition, named in honor of the great hero and discoverer, is now open at Chicago.

Russia, inspired with a long-felt sympathy, tending to unite the American and Russian peoples, has answered with the liveliest interest the invitation of the friendly Government of the United States, and has taken part in the great Exposition by sending various exhibits to represent the principal industries of the Empire.

The Minister of Finance, to whom His Imperial Majesty, the Emperor, deigned to entrust the care of the organization of the Russian Exhibit, could but recognize the fact that, however successful the choice of exhibits may be, they cannot convey an adequate idea of the productive forces of the Empire and its industrial development. To obtain such a view requires a more intimate acquaintance with the conditions under which our

commercial activity began. With this fact in full view, and stimulated by the desire to give the visitors to the World's Columbian Exposition a more correct and fuller representation of the contemporary state of the trade and industry of Russia. His Excellence, Mr. S. J. Vitte, Imperial Minister of Finance, at the close of the past year, instructed the Department of Trade and Manufactures to make a general review of the principal branches of the most developed industries of Russia, and of the internal and foreign trade, as well as of the customs policy.

To accomplish this very difficult task in the brief time allotted, the Department of Trade and Manufactures invited specialists in the several commercial and industrial departments to assist in the preparation of such a review, having entrusted the editing of the work in the Russian language to the worthy Professor of the St. Petersburg University, D. I. Mendeléeff, whose literary services are well known in the Old and in the New World.

The translation of this work into English was fraught at the beginning with very great difficulties, as there were no translators at hand who knew English and Russian sufficiently well and who were at the same time thoroughly acquainted with the technical terms of the several industries under consideration. Furthermore, skill and experience in writing were requisite to think out and select the proper expressions correctly to represent in English the many idiomatic and technical meanings of the several Russian authors. All these difficulties, however, were happily overcome through the kindness of the Consul-General of the United States, Mr. J. M. Crawford, who consented to supervise and edit the entire series of volumes on *The Industries of Russia*, embracing more than 1600 large octavo pages. Still further, is gratitude due to the Consul-General that he willingly undertook this very difficult task knowing that the time necessary for its accomplishment was exceedingly short. Nevertheless, the end has been attained, thanks to the fact that Mr. Crawford is thoroughly familiar with the Russian language and is also.

through his literary training and large experience, well acquainted with the several technical branches of industry included in this review. This enormous work is now drawing to a close; the first volume of *The Manufactures and Trade of Russia* is here presented, and the second is in press, while a third volume, on *Siberia*, is nearly ready.

The condition of the remaining branches of Russian Industry, the review of which is not included in these volumes, is represented in editions of other Departments. Thus, the Ministry of Crown Domains publishes a volume on *The Mining Industry*, a second volume on *Agriculture and Forestry*, and the Ministry of Ways of Communication, a *Review of the Railway and Steam-boat Lines of the Empire*.

V. I. Kovalevsky,

Director, Department
of Trade and Manufacture.

St. Petersburg, June 12, 1893.



PREFACE

TO

THE ENGLISH TRANSLATION.

Ever since becoming established at this post of the Consular Service, I have had a constant stream of inquiry from all branches of trade in the United States with reference to its especial development in Russia, there being no publication in the English tongue covering these subjects, and but few of our people having a sufficient knowledge of the Russian language to glean from the native literature the information desired.

In accepting, therefore, the invitation of the Imperial Minister of Finance to supervise and edit the English translation of *The Industries of Russia*, in its several volumes, I have undertaken the serious labour involved in such a work, not only with very great pleasure but also as an important duty, thus aiding to give the American people an insight into what is to them, commercially speaking, an unknown country.

In this, and in the volumes that immediately follow, a complete summary of Russian industries is impartially and accurately set forth, with the history of their growth from the earliest beginnings, together with the methods whereby Trade, Agri-

culture and Forestry have been advanced and improved until the present day. To His Excellence, Mr. Vladimir Ivanovich Kovalevsky, Director of the Department of Trade and Manufactures, Ministry of Finance, Privy Councillor, and President of the Imperial Russian Commission, World's Columbian Exposition, is due the credit and honour of elaborating the original idea of the Imperial Minister of Finance with reference to this work, and of drawing the entire plan, of superintending it in all its details, and of ably carrying it to completion.

In this translation I have made an effort to follow a uniform plan, and to harmonize, as far as limited time would permit, the varying styles of treatment and of expression found in the originals of the many authors who have prepared the articles on their several specialties. It has been my aim and endeavour to modify and, as far as practicable, correct the English orthography of many Russian names. To this end the compound consonants of the Russian alphabet have been uniformly rendered into English, and as simply as possible; furthermore, all case and gender endings have been dropped, especially of adjectives, as being of no value in English. For example, such adjectives as in the Russian designate the genders in *скон, скан, ское* (skoi, skaiia, skoie) have been shorn of their terminal vowels, and the reader will find, in consequence, such expressions as *Tambovsk* government, instead of the varying forms found in other English books, *Tamboffskoi, Tambowsky, Tambovskoy, Tamboffski* government. However, in the cases of old and very familiar Russian words that have become stereotyped in English literature in false dress, as *Moscow* for *Moskva*, *Archangel* for *Arkhangelsk*, *Ekaterinburg* for *Yekaterinburg*, they have been retained. Even that impossible, and therefore unpardonable spelling, *Nova Zembla* for *Novaia Zemlia* (New Land) will be found in this work in its old but false orthography. By special request that numerous class of words universally spelled in the United States with the termination *or*, as also that class ending in *er*, are written in

this work in *our* and *re*, according to the so-called English orthography.

The many imperfect sentences and positive errors that must inevitably be found in the pages of this, and of the succeeding volumes, should not be charged in the least to the original authors, but rather to the great difficulties under which the translations have been made. These difficulties may be faintly imagined when it is considered that the Russian text has been penned by very many specialists, with styles of composition as various as the subjects on which they have written, and that the typographical work has been done by casemen who have no knowledge of the language which they were setting up. The necessity for very rapid work, in order to present these volumes for distribution to the American public during the continuance of the World's Fair at Chicago, has also permitted many errors and inaccuracies, lying in full view, to escape correction.

While, therefore, begging the indulgence of the reader as to details, I can but feel that these volumes as a whole, because of the important and authentic information which they contain on the several industries of Russia, will be of inestimable value to the international trade of Russia and the United States, and if so, I shall feel amply rewarded for the labour and time spent on this work.

J. M. Crawford.

St. Petersburg, June 27, 1893.



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AND

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Russian Weights and Measures.

The following tables will serve to define the Russian weights and measures in terms of the French Metric System, as also in those which are used in the United States.

I. LONG MEASURE.

The lineal measures of Russia have for a unit the *foot*, which, according to the laws of Peter the Great, is the same as the English foot.

- 1 Russian foot = 1 English or United States foot.
- " = 12 inches = 120 lines = 1,200 points.
- " = 0.304794 metres = 30.4794 centimetres.
- 1 Russian arshine = 16 vershocks = 28 inches.
- " = 2 $\frac{1}{3}$ feet = 7 $\frac{1}{3}$ or 0.77778 yards = 0.71118 metres.
- 1 Russian sagene = 7 feet = 3 arshines.
- " = 2.13356 metres = 213.356 centimetres.
- " = 2.333 yards.
- 1 Russian verst = 500 sagues = 3,500 feet.
- " = 1066.77 metres = 1.06677 kilometres.
- " = 0.66269 English miles.
- 1 geographical mile = 6.956 versts = 7.420 kilometres.
- " = 4.601 English miles.

II. SQUARE MEASURE.

- 1 square sagene = 49 sq. feet = 4.5521 sq. metres.
- " = 5.4444 sq. yards.
- 1 dessiatine (Russian land measure) = 2,400 sq. sagues.
- " = 1.0925 hectares = 2.6997 acres.

- 1 square verst = 250,000 sq. sagues = 104.17 dessiatines.
 » = 1.1380 sq. kilometres.
 » = 0.43916 sq. English mile.
 1 sq. geographical mile = 48.38 square versts.
 » = 55.06 » kilometres.
 » = 21.25 » English miles.

III. CUBIC MEASURE.

- 1 cubic inch = 16.386 cubic centimetres.
 1 cubic sagene = 343 cubic feet.
 » = 9.712 cubic metres.
 » = 12.704 cubic yards.

Dry Measure.

- 1 chetvert = 8 chetveriks = 2.099 hectolitres.
 » = 5.9567 bushels.
 1 chetverik = 8 quarts = 1601.22 cubic inches.
 » = the volume of 64 Russian pounds of water at $13\frac{1}{3}^{\circ}$ R. temperature.
 » = 26.238 litres = 0.26238 hectolitres.
 » = 0.7446 bushels.

Liquid Measure.

- 1 vedro = $\frac{1}{40}$ of a barrel = 10 shtoffs or krouzhki = 750.57 cubic inches = volume of 30 Russian pounds of water at $13\frac{1}{3}^{\circ}$ R. temperature.
 » = 12.299 litres.
 » = 2.707 English, or 3.249 American gallons.

IV. AVOIRDUPOIS WEIGHT.

- 1 berkovets = 10 pounds = 0.1638 metric tons = 163.80 kilograms.
 » = 0.161217 English tons = 3.2243 cwt.
 1 poud = 40 Russian pounds = 0.01638 metric tons = 16.380 kilograms.
 » = 0.32243 cwt. or 32.243 Eng. lbs.
 1 Russian pound = 32 lots = 96 zolotniks = weight of 25.019 cubic inches of water at $13\frac{1}{3}^{\circ}$ R. in vacuo.
 » = 0.40951 kilograms = 409.51 grams.
 » = 0.90282 English pounds.

Troy Weight.

- 1 zolotnik = 96 dolee.
 » = 4.2657 grams.
 » = 65.830 grains, Troy.

INTRODUCTION.

Review of the Manufacturing Industry and of the Trade of Russia.

THE Russian branch of the Slavonic peoples, occupying from immemorial times as colonists the western half of the immense plain stretching for two and one-half thousand kilometres from the rocks of Finland to the mountains of the Caucasus, and from the Carpathians to the Urals, from necessity, from the rapidity of its natural increase, from its inclination to peaceful domestic occupations, and finally from its habit of struggling against the difficulties presented by nature, has ever been mainly occupied with agricultural pursuits. Trade relations were assisted by the vast rivers and the winter sledge roads, but were hindered by the lack of seacoast, extensive forests, the raids of the tribes of Finnish and Mongolian descent, and the internal disorder which caused the people in the ninth century to elect princes whose chief care consisted in the establishment of internal organization and external defense from those neighbouring tribes which had partly fallen away from, partly been assimilated by Russia. The division of the country into many separate principalities, the warring of the princes the imposition for two centuries of the Mongol yoke, the ceaseless defensive wars undertaken against The Swedes and the Teutonic knights pressing on from the north-west, against the Poles who had deprived Russia of her western and south-western territories, and against the Tartars who attacked her from the east and south-east, all this occupied the Russian people even in the fourteenth, fifteenth and sixteenth centuries to such an extent that there was little possibility of beginning any lasting industrial development. Only in the seventeenth century the Moscovite Tsars, after uniting the people and strengthening their authority with the aid of the most enterprising inhabitants of the Moscow region, were in a position to present stout resistance to the west, and having finally broken the force of their eastern enemies, were able to begin to think about the

development of Russian trade and industry. Opening with the great reforms of Peter the Great, the eighteenth century already brings Russia into the circle of nations with a trading and industrial organisation. But these efforts were opposed by the wars with the Swedes, ending with the occupation of the Baltic provinces, the wars in the south for pushing back the Turks who had already succeeded in seizing the northern shores of the Black Sea and the territories of the related Slaves, and the ceaseless extension to the east where unorganised Asiatic hordes long prevented the establishment of peace and order to which the Russian people ever strove, and which it attained so lately. The beginning of the nineteenth century bears the same character in consequence of the invasion by Napoleon, the Turkish wars and the forcible introduction of an orderly rule in the Caucasus and the Central Asiatic territories, where it was impossible to permit the constant raids upon the country and rapes of the inhabitants by petty Asiatic rulers. At this time trade relations with the west began to develop principally in agricultural raw materials, the production of which visibly increased in proportion as order was established, and to such an extent that the surplus of grain, hemp, flax, timber and wool, chiefly from the Chernoziom zone of Russia, began to be sent in abundance to the markets of Western Europe, and furnished grounds for regarding Russia as an exclusively agricultural country, a view justified by the whole structure of Russia's past existence.

Although the Government, and a few enlightened people, made great efforts to establish in Russia various forms of mining and manufacturing industry, and although the rapid development, at the time, of certain works and manufactories, for example, the metallurgical works in the Urals, the factories around Moscow, the beet industry near Kiev, the petroleum industry in Baku, demonstrated the combination of conditions existing for the purpose in Russia, nevertheless the industrial development of the Empire moved very slowly and yielded not only to the other aspects of the growth of Russia's forces, for example, the development of science, the advances of literature, music and painting, the increase of the means of warlike defense, but also to the growing demand for articles of foreign production. As an illustration of the latter, may be taken the import of wine which in 1850 amounted to seventy-six million roubles across the west European frontier, while in 1875 it reached five hundred and twelve million roubles, or an increase in twenty-five years of nearly 700 per cent.

The chief cause of the feebleness of the development of the home manufacturing industry consisted for a long time in the whole organisation of former Russian life, which was concentrated in the peasantry, which directed all its energies to agricultural production and employed for the attainment of this object only the means which lay at hand, such as the replacement of lands exhausted by cultivation by fresh lots, home-made implements and the felling of forests. The rural gentry, or large landholders, having serf labourers bound to them, employed them also mainly in the cultivation of the land and, like the peasants, strove to satisfy their wants as far as possible from their domestic resources, only having recourse to the productions of manufacturing industry as a luxury. Thus houses were built chiefly of wood from their own estates by their own carpenters, who had attained extraordinary skill in their trade. Clothing also was in the main woven from home-grown flax and wool, or made from home furs and skins. In the matter of food the people confined themselves so strictly to

their domestic resources that the preparation for winter of various preserves, beginning with salted and soured vegetables and ending with the making of confectionery and sparkling drinks, formed part of the business of every well to do household. This patriarchal state of domestic economy, preserved with due reverence for the old order of things, here and there to this day prevailed over the whole country even in the middle of the present century. There was thus little room for the demand for the products of manufacture, a fact which till now serves as the chief explanation of the feeble development of the latter in the Empire. All that there is in this respect is almost entirely new. Mills and manufactories first appeared in those places where, from the growth of the population and from the exhaustion of the soil or the want of land, the conditions permitting of the indefinite preservation of the beloved patriarchal system were disappearing. Particularly, and earlier than anywhere else, was this the case in localities situated near Moscow, where there is already a very dense population. In that government for example, more than 2,250,000 inhabitants live upon an area of 33,300 square kilometres, or about 68 inhabitants to the square kilometre*. At the same time the dwellers in the central or Moscow region of Russia have been distinguished in all respects from the earliest times by the greatest enterprise, and have always been to the fore in seeking out new roads for the lasting development and strength of their country. With the increase of population in this heart of Russia, for a long time and even to-day, the surplus had colonised the more distant districts of the Empire, but notwithstanding this, here earlier than elsewhere, appeared the conditions necessary for the springing up of mills and manufactories requiring unemployed labour, no longer satisfied with agriculture alone. Accordingly the neighbourhood of Moscow has become the centre for the free and independent growth of many kinds of manufactories and works, where also have been situated from ancient times the centre of Russia's trade relations, not only with the interior but also with foreign countries and especially with Asia.

The present volume is intended to acquaint our country's friends in the United States, and those visiting the World's Columbian Exposition, with the economic life of Russia. The conditions then which favoured the visible growth, or at times, as in the case of sugar and petroleum, the very origin of manufacturing industry, began to appear and improve principally in that period of the sixties and seventies, when the serfs were emancipated from forced labour, and the active construction of the system of Russian railways was begun. The causes of the close connection between these internal reforms and the demonstrations of the necessity for the development of mills and manufactories are numerous. The most important cause must be accounted, that the land began to be tilled by free labour and consequently this labour became more productive than before, and a number of people accordingly appeared seeking for wares, outside of agriculture, although all the peasants had received land allotments, and although the lands of the landholders, both by way of lease and by hired labourers, were brought under more thorough tillage. This latter circumstance was still further helped by the railways which gave an outlet abroad to the grain surplus of many remote regions of Russia. Almost an equal importance is ascribable to certain other causes,

* For comparison be it observed that in Germany there are about 49.5 million inhabitants to 541 thousand square kilometres, or 91 inhabitants to one square kilometre.

among which was the increased demand of all classes of the population for manufactured articles, especially leather, glass, iron, kerosene. Next came the increase of free capital, called forth by the development of banking operations, founded on the issue of land-redemption certificates, or the mortgaging of land and houses, and the circulation of various shares and bonds, a practice until then very rare in Russia. Lastly, must be noticed the propagation of the manners and customs of the towns over the whole country now intersected by railways, whose appearance gave an impulse to every kind of exchange.

The growing demand for manufactured articles in its turn helped to give life to railway enterprise, but the latter did not show the energy that might have been expected. This circumstance depended in the first place upon the fact Russia's customs tariff, which had been in operation during the period 1857 to 1877, when the internal demand had become very brisk, protected only that which had received its initial development earlier than that period, for example manufactures, or fostered only the working up of raw materials, admitting without duty, sometimes with low fiscal dues, raw and half-manufactured goods, such as cast iron, steel, cotton, sulphur and coal. The mills and manufactories which sprang up at that time frequently had the character of finishing works. They received all the chief raw and half-manufactured materials from abroad and completed their manufacture in Russia, in order to profit by the advantages presented by the protective tariff on finished goods. As an example, may be taken the working up of foreign cast iron into iron and steel rails and the making of cement with the aid of foreign lime and coal on the seacoast. This cause of development of the mills and manufactories was the more faulty because the products obtained from foreign raw material had not the capacity for becoming cheaper, yielded the people but little wages, hindered the development of internal productive industry and, in general, contributed little to the industrial progress of the country. Nevertheless these manufactories, together with the increased demand arising among the people on their passage from their formal patriarchal life to one more complicated, and with greater requirements in reference to manufactured goods, and the construction of railways referred to above, served to throw a certain amount of animation into the whole manufacturing enterprise of Russia, a movement which dates from the seventies. This industrial life became evident with the year 1877, when on account of the needs of the treasury, and later when in the interests of the development of the home industries, the customs duties began to be raised as compared with those which in the sixties were thought to answer to the internal demand, aided by foreign importation. In order to form a more just opinion of the importance of customs duties in the interest excited in the last fifteen years in Russia's manufacturing activity, it is necessary to become acquainted with the particulars relating to the protective policy of the country, set forth by the Vice-Director of the Department of Trade and Manufactures, V. J. Timiriazev, in the Chapter upon the Customs Policy of Russia, and in the Chapter by A. J. Stein, Chief of the Statistical Section of the Department of Customs Duties, upon the Foreign Trade of Russia. In this Introduction only a few general facts, founded upon data which depict the situation of Russia in respect to the productiveness of her mills and manufactories, her trade balance and her customs, will be noticed. Seeing that the amount of the latter is closely connected with the conditions which determine the origin of mills and

manufactories a general account of Russian customs should occupy the first place. Attention will first be directed to the fact that the ratios per cent of the total revenue of the State to its customs revenue, and of the value of all the foreign goods imported into Russia to the duties levied, have been continually growing during the last twenty years, although a constant increase is observable in the amount of all sources of revenue and an evident diminution in the quantity of foreign goods imported has already begun, corresponding to the awakening of home production.

TABLE 1.

	Per annum.			Ratio per cent of :	
	Mean Imperial reve- nue *.	Mean cus- toms revenue.	Mean value of imports **.		
				B to A.	B to C.
	Millions of paper roubles.				
	A	B	C		
1869—1873 . . .	477	49	390	10 per cent	12 per cent
1874—1878 . . .	554	66	484	12	14
1879—1883 . . .	668	94	573	14	16
1884—1888 . . .	734	109	438	15	25
1889—1891	834	136	411	16	33

In order that the preceding figures may obtain, the comparative value of the corresponding figures for the period between 1887 and 1889 for different countries should be contrasted:

TABLE 2.

	Millions.			Ratio.	
	A	B	C	B : A	B : C
1887—1888. Argentine Republic, dollars. .	54	39	117	72 per cent	33 per cent
1886—1889. Brazil, milreis.	139	84	209	60 „ „	40 „ „
1888. Great Britain, pounds sterling.	90	20	387	22 „ „	5 „ „
1887—1889. German Empire, marks . . .	865	254	3189	29 „ „	8 „ „
1888. France, francs	3011	347	4053	12 „ „	9 „ „
1887—1888. Italy, liras	1644	281	1601	17 „ „	18 „ „
1888. China, taels.	72	21	102	29 „ „	21 „ „
1887—1888. Russia, paper roubles	770	124	392	16 „ „	32 „ „
1888—1889. United States, dollars	377	217	724	58 „ „	30 „ „

* Under revenue, are counted only ordinary revenue of all kinds without reckoning redemption operations.

** The value of imported goods is determined by the declarations of importers, verified and corrected by the Customs Department. As *ad valorem* duties have long since disappeared in Russia, there is no reason to doubt the closeness of the declarations to the truth. The amount of contraband undoubtedly forms but a small part of the imports, and is decreasing every year.

*** Scott Keltiés, «The Statesman's Year Book for 1889.

Hence it appears that customs revenues in Russia form a smaller part of the ordinary Imperial revenue than in the majority of other countries, while the duties levied upon foreign goods in per cents in Russia reach the extent adopted in the countries of North and South America, that is, in countries with a large home productive capacity for raw materials, but with a small development of manufacturing industry. In the countries of Western Europe on the other hand, the customs duties form a less percentage, namely, 5 to 18 per cent of the value, than in Russia, where the percentage is 32 per cent. The feeble development of manufactories and mills in Russia, the vast natural resources, especially the abundance of mineral, vegetable and animal raw materials, and the surplus of population requiring other sources of wages than agriculture, explain the above phenomenon, both in resemblance to the countries of the American continent and to the variance with the countries of Western Europe.

Furthermore the customs duties of Russia concern, in the main, articles either not forming an indispensable popular demand, as for example, delicacies for the table, articles of luxury, and others, or such as tea which produces twenty per cent of the customs revenue. The latter, like those articles upon which indirect taxes are levied in the form of excise (spirit, sugar, kerosene) are employed in small quantities, and everywhere bear high dues without burdening the consumer. Finally, come those articles which are produced by Russia itself in sufficient quantities to satisfy the growing home demand, as coal, iron, manufactured goods and salt, with the greatest advantage to the inhabitants, seeing that the getting and treatment of these articles furnish the people with wages. But their production cannot be developed if foreign goods are admitted duty free. The great increase in the home production of cotton goods (Chapter I), cast iron, coal, sugar, the products obtained from the treatment of petroleum, and even gutta-percha goods, already exported to Western Europe (Chapter VII), coinciding with the temporary introduction of protective duties, clearly demonstrates the expediency of the application of the principles of protection with the object of rousing the people to strengthen those forms of industry to which the natural resources and forces of the country correspond, precisely at a time when the change has begun from the patriarchal agricultural life to the more complex one, consisting in the combination of agricultural activity with mining and manufacturing industry. The constant growth of the latter is evident from a reference to the change in the annual amount of the values of these products (Table 3). In quoting these data, it is necessary to write the reservation that exact statistical registration can only be expected for such forms of industry as bear special duties, as for example, the getting of gold, platinum and other metals, the production of alcohol and other articles subject to excise. The majority of other kinds of manufactures do not possess special organs for the collection of statistical information, being gathered by the governors through the ordinary police officials, and therefore suffer from incompleteness. This inaccuracy is again increased by the circumstance that the household or small peasant, and indeed all minor forms of production due to the class of half-artisans, occurring in great abundance in different parts of Russia, are utterly incapable of registration. At the same time these scattered industries, as in the case of the manufacture of articles in wood, boxes, wheels, tar, pottery, leather and nails, are occasionally, from the amount of their production, of great importance both for the development of industry in general, and for the prosperity of the population. It should be noticed that the majority of

industries in Russia are free, being subject to but two forms of taxation, namely, the trade license and a tax on income levied per centum, or proportionally. The latter is in effect a peculiar kind of income tax. In reference to the class of products mentioned above subject to taxation or excise, although the quantity produced thus becomes clearly ascertained, their value without excise is liable to fluctuations not easily determined, not unfrequently, especially in the case of spirit, dependent upon the conditions of the payment of excise. The sources of the statistical data set forth below are the detailed official accounts annually published by three Departments, namely, Trade and Manufacture, Excise, and Mining.

TABLE 3.

YEARS.	1.	2.	3.	4.
	Annual production of non-excise manufactures.	Annual production of excisable manufactures.	Annual production of mining industry.	TOTAL.
Millions of paper roubles.				
1878	583	197	120	905
1879	776	213	141	1,130
1880	841	216	157	1,214
1881	839	294	154	1,287
1882	896	329	153	1,378
1883	856	344	149	1,349
1884	836	320	148	1,304
1885	829	335	145	1,309
1886	848	323	154	1,325
1887	921	348	158	1,427
1888	1,013	393	166	1,572
1889	1,028	392	186	1,606
1890	1,064	403	189	1,656

1. The figures in this as in the other columns must be regarded as approximate, exclusive of minor industries. The manufactories and mills included in this column are registered by the Department of Trade and Manufactures. Here enter neither the works whose productions pay excise nor those which produce metals.

2. Under this rubric the production is estimated by the approximate mean values of the articles produced. The values for alcohol and illuminating oils are taken without excise; for the remaining articles, with excise. The products of the naphtha, match and yeast manufactures are shown in totals for all the years, although the excise in the cases was introduced only in 1888. These figures differ from those given in the following tables, for example, the fifth, as certain excises are entered here, as also all the products from the distillation of naphtha.

3. Under this rubric are included, gold, silver, platinum, copper, lead, zinc, tin, cast iron, coal and salt, iron and bronze founding, iron manufactures, steel and rails, while ores of manganese and chromium, sulphur, asphalt, naphtha, porcelain, clay, phosphates, Glauber's salt and iron pyrites have been omitted. The latter were unknown in the previous years and are entered in the total for mining production given for 1890 in the following Table 5.

4. The totals of this table do not include data referring to Finland with the exception of mining. The year 1878 omits the data for Poland. Further, the table does not cover small manufacturing undertakings nor household industry, in consequence of which the actual production is much higher than that stated. Photography, printing, baking and similar industries are also not included in the rubrics of this table, but are to be found in Table 6.

It is exceedingly important to direct attention to the fact that the considerable taxation to which the excitable forms of manufacturing industry are subjected, namely, spirit, sugar, kerosene, matches, tobacco, does not stop the development of these industries. This is seen from the fact that during the thirteen years indicated in the table these productions fully doubled, which is undoubtedly connected with the simultaneous growth of other forms of industry, the latter giving the people the means to pay considerable excise duties, whose annual amount is to be seen from the following figures taken from the accounts of the State Control.

	1882.	1885.	1888.	1891.
	Millions of paper roubles.			
Spirits, beer and other alcoholic drinks . . .	253.0	231.3	265.1	247.4
Tobacco.	14.8	19.7	28.1	28.6
Sugar	8.1	13.9	17.1	20.9
Kerosene *	—	—	6.6	10.2
Matches	—	—	2.7	4.7

Producing about 300,000,000 roubles of annual Imperial revenue, the excise duties fall upon manufactured articles, whose total value hardly exceeds 400,000,000 roubles, or increase their total value by at least 75 per cent. Among them spirituous liquors, sugar, matches, and kerosene satisfy such popular needs as are much more important than those which are served by the great bulk of foreign goods upon which is levied a much lower duty than the excise. The amount of the former appears from the fact that the customs duties for 1890 equalled 142,000,000 roubles, while the value of the imported goods in that year is stated as 416,000,000 paper roubles. The custom duties thus formed 34 per cent of the value of the imported goods, which nearly equalled the value of the manufactured goods paying excise. Moreover, seeing that the extent to which such duties are imposed

* Excise upon illuminating petroleum, oils and matches was introduced in 1887. There is no tax on salt in Russia.

in Russia not only does not exceed but even falls short of that which exists in the majority of transatlantic countries, seeing that in Russia articles of prime necessity support no indirect taxes whatever, (salt bears no excise, and grain no custom duties), finally seeing that high excise duties do not retard the development of the consumption of the corresponding products, and that the bulk of the excise especially on alcohol is paid by the working classes while foreign wares are, more or less required by all classes of the inhabitants interested in the development of home industry, articles of luxury being chiefly consumed by the upper classes, in which case customs duties to a certain extent equalise the burdens of imperial taxation, therefore the combined excise and customs duties form a perfectly rational basis for the financial resources of the Empire, and the noticeable contraction in the quantity of imported foreign goods (Table 1) must be ascribed to nothing else than to the development of home industry, particularly mining and manufacturing.

The heavy personal and land taxes which formerly existed are little by little being excluded from the budgets of the Russian Empire and gradually being replaced by taxes upon consumption. The objects of taxation are mainly, directly or indirectly, the manufactories, mills and trade. The imperial burdens are thus placed chiefly upon the industrial class of the population, instead of as formerly upon land and the agricultural class. This transfer forms one of the most important financial undertakings of modern internal life in Russia.

The numerical proof of such an assertion clearly follows from the comparison of the total values of the recorded home productions and foreign imports, quoted for the eleven years from 1880 to 1890.

TABLE 4.

Y E A R S.	Amount of home manufactures. (Table 3)	Value of foreign imports *.	Total consump- tion of articles not of domestic manufacture.
Millions of roubles.			
1880	1214	604	1818
1881	1287	541	1828
1882	1378	568	1946
1883	1349	562	1911
1884	1304	538	1842
1885	1309	434	1743
1886	1325	438	1763
1887	1427	393	1820
1888	1572	390	1962
1889	1606	437	2043
1890	1656	416	2072
	Mean	Mean	Mean
	1325	529	1854
	Mean	Mean	Mean
	1517	415	1932

* The figures here quoted refer to the values of goods examined in the customhouses.

In other words, the amount of home consumption in reference to goods of domestic production and obtained from abroad or from the home mining industries and from the larger home mills and manufactories, remains almost constant or grows only to a slight extent proportional to the increase of the population. A manifest increase appears only from the year 1887, but it is impossible, not to see an evident although slow growth of the home production at the expense of the foreign imports, which constitutes the prime object of a protective customs policy. The growth of the home manufacturing production, regulated by the Department of Trade and Manufactures is clearly to be seen in Table 3, from the amount of 841,000,000 roubles in 1880 and 1,064,000,000 roubles in 1890, for the whole Empire excepting Finland. From Table 4 it appears that the importation of foreign goods for the said years is equal to 604 and 416 million roubles. The amount for 1880 is 841 and 604 million roubles, or 1,445 million roubles; and for 1890, 1,064 and 416, or 1,480 million roubles. But as some of the chief articles of foreign importation consist of the productions of mills and manufactories, evidently the development of the home manufacturing industry of Russia is now taking place mainly at the expense of foreign productions. Such a growth, of course, only forms the first step in the development of the internal economical forces of the country, the crown of which is formed, on the one hand, by the growth of various requirements expressed in the amount of expenditure necessary for their satisfaction or in the growth of the buying capacity of the whole people, and on the other hand, by the growth of the export of the surplus of such goods upon which is expended the floating capital or its renewable energy, and not the fundamental capital of the country, as is the case in the export of grain, expending the fertility of the soil, or the export of coal the supplies of which cannot be renewed.

Thus England receiving cotton and wool and exporting goods made therefrom, Russia exporting flax, and the United States exporting cotton, expend not the forces of the soil of their respective lands but only the labour of their inhabitants and the work due to the solar heat of the countries. The carbohydrate principles of flax or cotton fibre do not contain soil elements determining fertility. But if Russia instead of flax, or the United States instead of cotton, exported fabrics prepared from them, evidently the productive forces of these countries would enjoy a higher degree of sufficiency than now. The present industrial policy of Russia is directed precisely to the end that the productive forces of the country should be turned to the manufacture of the abundant supplies of agricultural and mineral raw materials in the Empire, that the people may obtain new sources of wages and income and that the buying capacity and wealth of the country may be increased. The demand for articles not of domestic production is still small, but it is always better for the inhabitants when they are satisfied by such means as yield them new wages and permit them, even if only partially, to become accustomed to the satisfaction of their growing needs at the expense of increasing the development of the natural resources of the country. The growth of their production at the same time forms an increase in the world's supply, and this at last leads to a lowering of prices. With the present course of affairs, the home manufacturing industry is annually widening at the expense of foreign imports at the rate of about 40 million roubles, although the total demand for manufactured articles grows more slowly.

Remaining in the country this sum goes to enlarge the national wealth. Russia now consumes annually about two milliard roubles worth of goods of this kind, or reckoning about 120 million inhabitants, not more than 17 roubles a head. This comparatively small demand for products not of domestic or agricultural origin is determined not only by the predominance of the rural population striving to this day to satisfy all its needs through home productions, but also by the two considerations set forth below.

When with the abolition of the obligatory labour of the serfs in the sixties, the unsatisfactory character of the former patriarchal system of economy and the impossibility of its continuance became evident, and at the same time the necessity appeared for the development of industry, the conditions did not then exist for the birth and growth of a home manufacturing and mining activity. A demand for goods of this description began to be made by the country, but the satisfying of this demand was effected by means of foreign producers, the customs policy of that time being directed solely to the protection of existing kinds of industry and paying no attention to the establishment at home of the production of goods, the demand for which only became evident with the construction of railways. Thus, for example, notwithstanding the immense supplies of coal existing in Russia, foreign coal was admitted till 1884 duty free, while cast iron paid only an insignificant duty of 5 kopecks per pound at a time when the demand for it and for goods made from it, as iron and steel manufactures, grew to a great extent in consequence of the construction of railways. Thus during the twelve years only from 1869 to 1881 the annual imports into Russia were on an average as seen below.

	IN THOUSANDS OF POUNDS PER YEAR.		
	1869—1872.	1873—1876.	1877—1880.
Cast iron. . . .	3,263	4,129	9,319
Iron and steel . .	15,144	20,768	18,124
Machinery	3,620	4,639	7,487

The total value of these imports for these twelve years only exceeded 1,100,000,000 roubles, and the payments for them formed one of the principal causes of the fall of the paper rouble. In the forties the value of the gold rouble was on a par with that of the paper rouble; in the fifties, 100 gold roubles equalled 101 to 110 paper; in the sixties, 105 to 132; during the period 1869—1872, from 118 to 130; in 1873—1876, from 119 to 151; in 1877—1880, from 154 to 159; in the eighties, from 180 to 181 paper roubles; in 1890 the ratio was, 100 gold varied from 125 to 147 paper.

At the same time the conditions always existed in Russia for the satisfaction of this demand by means of developing the home production. The demonstration of this fact is now to be seen in the greatly increasing production of cast iron, iron and steel goods, from the time when the principles of customs protection were ap-

plied to this industry. The demand for goods manufactured from cast iron has not diminished but has ever increased during recent years, while the satisfaction of this demand by home production began to grow only from the year 1883 when efficient measures were resorted to in order to enable the home production of cast iron, and iron and steel wares, to grow and compete with the earlier developed foreign production. In the sixties only about 20 million pounds of cast iron were obtained in Russia and the whole requirements of the country in cast iron, counting one pound of iron equal to one and a quarter pounds of cast iron and one pound of machinery equal to one and one-half pounds of cast iron, unavoidable losses taking place in the course of manufacture, reached 50 million pounds of cast iron. Russia's requirement remained about the same during the whole of the seventies when the home production was not able to satisfy more than 40 per cent of the existing demand. During the eighties the total requirement already exceeded 60 million pounds of cast iron per annum while the home production rose from 28 million to 56 millions, in other words, satisfied from half to two-thirds of the demand. During the current decade this branch of the industry has been growing still more, reaching in all, inclusive of cast iron, steel and iron, more than 70 million pounds. At the same time the home production is growing much faster than the increase in the demand, so that the import of foreign goods is falling greatly and the time is not far distant when the native production of iron, cast iron and steel will cover the demand and even surpass it. This will inevitably lead to a fall in prices and to a growth in the export which has long existed for Russian iron. In the same manner as in this branch of industry, a growth likewise began not long ago in many kinds of production, both mining and manufacturing, will correspond to the forces and requirements of Russia. Such a growth is taking place gradually and increasing the development of the home wages and wealth among the masses of the people.

The fate of the Russian petroleum industry serves as the best proof of the fact that the home mining and manufacturing forces of Russia are only awaiting an impulse to excite an increased growth. Customs protection here was granted in the sixties. According to the tariff of the year 1868, crude petroleum already paid 15 kopecks paper duty, while kerosene and machine oil paid 55 kopecks paper per pound. The petroleum industry being considered further on, in this volume, it will be sufficient here merely to point out that already in 1876, Russia imported a large amount of American petroleum products, in that year 2,666,666 pounds of illuminating oil alone. In the eighties not only the importation of foreign petroleum products ceased, but the export increased greatly, reaching already in 1890, 48 million pounds. Nor is this all, while the home consumption in 1876, with the excessively high prices of all articles of this kind, scarcely attained 4 million pounds, in 1890 the consumption within the country of illuminating oil alone rose to more than 30 million pounds, due to the rapid fall of prices. In Baku purified lighting oil now costs on the spot not more than 15 kopecks a pound. In view of this cheapness the Government has imposed an excise duty upon the home consumption of kerosene, which in 1890 yielded 10,500,000 roubles of revenue. A similar growth in the coal, iron, chemical and many other kinds of industries, made be expected as soon as the principles of a reasonable protection are applied to the productions of goods of these kinds. The development of the working of many of the natural resources of Russia

will lead not only to the lowering of their prices and the enlargement of their consumption, but also to the increase of wealth and prosperity, or as a consequence to the increase of the demand for goods not of domestic production. The example of the petroleum industry shows that several decades of years are required for the attainment of the proper growth of the Russian home manufacturing industry. The treatment on a large scale of petroleum in Baku was begun in 1862, while the almost complete suppression of foreign imports corresponds to the year 1882. The policy of a carefully thought out protection extended to various productions had scarcely begun in the middle of the eighties; the fruits, however, are already beginning to show themselves, although it is impossible to expect a complete result, especially the manifest enlargement of home consumption earlier than the beginning of the next century. The consequence of the prevalence of the conviction in the brilliant period of the sixties, when many sides of Russian life were being reformed, is that Russia as an exclusively agricultural country should not make any special efforts to develop its mining and manufacturing industries, being in a position to advantageously obtain in exchange for its grain all kinds of manufactured goods from foreigners. A result of such a view is not only the feeble development in Russia of mining and manufacturing industry, but the small buying power of the people, clearly expressed by the above figure of 17 paper roubles for each inhabitant. The industry which has been customary and from immemorial time peculiar to the Russian people, the growing of grain, has during the past twenty years suffered a great change throughout the whole world. This has had as a consequence the result of lowering the prices for grain produce during this period instead of advancing them. This phenomenon is generally known, but at the same time it may not be out of place to illustrate it objectively, making use for this purpose of the account of the Hamburg Exchange (Hamburg's Handel und Schifffahrt, 1888), where on Table 2, is shown the change in the prices of more than 300 articles from 1847 to 1888. For wheat the average price in marks per 100 kilos was as follows:

1847—50	1851—55	1856—60	1861—65	1866—70	1871—75	1876—80	1881—85	1886	1887	1888
19	23	23	20	23	24	22	19	15.1	15.0	14.4

Accordingly the average price for the fifties must be taken as 23 marks, for the sixties 21.50, for the seventies, again about 23, while it was about 15 at the end of the eighties. The fall from 23 to 15 marks shows a decline of 8 marks, while in reference to the prices prevailing at the end of the eighties this forms more than 50 per cent. Hence is evident the cause of the fact that the countries importing grain began in the eighties to protect their domestic production by import duties upon all forms of grain, as of the fact also that in countries exporting grain like Russia there appeared the deficits of the grain producers, leading to the making of every effort to diminish all general expenses upon grain, especially those arising from trade. The essence of the business is included in the following. The consumption of grain increases very slowly and proportionately to the growth of the

population, and depends in hardly any degree upon the decline of prices. The consumption of other goods on the contrary, for example, manufactured and mineral, grows incomparably faster. Thus the production of coal upon the whole of the earth's surface in 1850 was not more than 90 million tons; in 1890 it was more than 400 millions, i. e., in the course of 40 years the consumption of such articles increases with the fall in price. The production of grain required by industrial countries with the development of universal peace and trade relations, especially by sea, becomes most advantageous in subtropical countries, inhabited by peoples possessed of little energy and requiring to be supplied with the products of manufacture. Hence it follows that in the not distant future, countries like the United States and Russia, where the population is rapidly growing and industry developing, will cease the now existing export of grain and will direct their energies to the export of agricultural products only in the manufactured state.

The fall in the prices of grain products referred to above is due to two causes. In the first place, the number of countries supplying the western European markets, as England, Germany, France, Italy, Holland, and Belgium with grain, has lately increased, not only by the great rise in the imports from the United States but by supplies also from Austria, Roumania, India, Australia, South America and Africa. Such a result was due to the prevailing peace and to the cheapening of transport by sea. The increase of the supply of grain from countries not exhausted by agriculture, and especially from subtropical countries where labour is frequently recompensed by insignificant wages, brought about the result that the consumers producing manufactured articles lowered the prices on the grain they bought and were thus enabled to lower also the prices of the manufactures they supplied in return. The second cause of the lowering of the prices of corn upon the western European markets was the introduction by many countries, such as Germany, France, Italy and Greece, of customs duties upon foreign grain, with a view to protect the earnings of the home farmers. The Russian farmers, namely, the great bulk of the population, lost heavily from the fall in grain prices referred to. The cheapening of freights and a certain regulation of the conditions of the immense home and foreign grain trade of Russia mitigated the burden proceeding from the reduction in the prices of grain, but at the same time various symptoms began to show themselves of the impossibility of relying upon agriculture alone for the further development of the economical life of the country. Thus, for example, the improvement in the exchange of the paper rouble, so useful for all government and economical relations of Russia abroad, is obviously impeded by the circumstance that upon every improvement of the exchange, Russian farmers, that is, almost half Russia for the other half has to buy grain (Table 5) who are paid in paper roubles, have to bear losses dependent on the fall of the price of their production, already cheapened of late. For the solution of the problem confronting Russia, namely, how to improve the exchange and at the same time increase the wages and wealth of the whole population, there are two methods and their combinations suggested. These are first, to increase the price of the grain exported from Russia, and second, to enlarge the other earnings of its inhabitants. But the first method is not within the power of the people and does not satisfy all interests, because part of Russia are buyers and not sellers of grain (Table 5). At the same time the rise of prices of grain over the whole world must come of itself, in

the natural course of commerce; it is only necessary to wait. Therefore, there remains the second way, that is, the development in Russia of the industrial treatment of its other natural resources, under the conviction that it will lead not only to the increase of the national earnings, but to the export from Russia of various productions of its mining and manufacturing industry. With its cheap grain, with the existing preparation and the variety of the natural resources of the country this is possible for Russia more than for many other countries. This explains the increased protection during the present reign and the transitory economical condition from purely agricultural to industrial agricultural, in which the country now is.

The felling of many forests, the lack of moisture and the consequent repeated cases of crop failures are forcing the adoption of more thorough and rational methods of agriculture. But the absence of the development of manufacturing industry precisely in those governments of Russia which are the preeminent furnishers of grain, places a limit to efforts of this kind, as the cultivation of artificial grasses, roots and plants having a commercial importance cannot be widely developed unless the neighbourhood of industrial enterprises consumes them. Such kinds of agricultural products form the foundation of intensive systems of cultivation, already become necessary, in the majority of the localities of European Russia. Hence although the production of breadstuffs, mainly grain, in Russia has largely increased since the sixties, this has not led to an increase of the wealth in the agricultural districts of the Empire. Thus is explained the above indicated small demand for goods not of domestic production, and the feeble growth of the demand for such goods in late years.

Besides the transmigration to fresh lands, Siberia, the Caucasus or Russia's Central Asiatic possessions, now regulated and partly encouraged by Government measures, a happy issue from the situation is principally to be seen in the universal development of the mining and manufacturing industries throughout the whole of the Empire. Thus it will be made possible to extend the intensive system of agriculture and to increase its profitableness and thereby open new sources of wages to the people. The government has had recourse, therefore, to such a rational form of protection as should help to enhance the development of the working of the natural wealth of the country and of the treatment in manufactories and mills of every kind of raw material produced outside the country.

The turn taken by Russian economical life in this direction, coincides with the beginning of the eighties, that is, to the time of the beginning of the reign of the present Emperor, Alexander Alexandrovich, but receives the most evident expression in the new tariff of 1891. This began at first in very moderate dimensions to protect the raising of all kinds of minerals, for example, sulphur and pyrites, all sorts of ores, stones and coal. At the same time this tariff proceeded to encourage more highly than had the former the existing forms of industry employed in working up home raw materials, and to call new methods into being. This was particularly the case with the chemical manufacturing and metal industries and such rural occupations, as wine making, the making of all kinds of preserves, the preparation of artificial fertilizers, starch, products obtained from wood, such as turpentine, resin, cellulose, and of every kind of agricultural manufactured product. The fruits of this policy are already clearly apparent, and first of all in the direction taken by agri-

cultural activity. An obvious proof of this statement is the rapid growth of cotton planting in the warm regions of Russia, as explained in Volume I of this work and in Chapter I, of this volume.

A proof of the growth of the chemical industry in Russia, due to the application of protection, is to be seen in the establishment of the soda industry, the manufacture of bleaching powder, and in the increase of every kind of chemical works, taken place in the last few years. Among the fresh successes of manufacturing industry must be reckoned, above and beyond the increase in the total production, the growth in the export of cotton goods, now accompanied by return of the customs duties on cotton and dyes, the extension of silk growing, the establishment of silk-throwing machines, and the rapid increase in the production of vicuna and similar warm fabrics, containing wool and cotton.

The metallurgical movement shows not only a rapid growth in the production of iron, which has already put a stop to the importation of rails, but in the increase of production of all sorts of machines, the development of the getting of mercury, copper, lead and zinc in regions like that of the Donets, where formerly no industries of the kind existed, and where the abundance of coal especially favors it. The spread of phosphate mills, answering to the plentiful finds of beds of phosphate rock in many places will assist in increasing the abundance of the harvests, while the development of works for the construction of agricultural machinery, which has already begun, will facilitate and cheapen all kinds of agricultural labours. At the same time they will, like all development of manufactories and mills, furnish wages to the masses of the population and local buyers for the products of agriculture. All these and many other kinds of manufacturing activity in Russia are, however, now only passing through the initial period of their origin, and therefore still encounter many obstacles of various kinds. Thus, many forms of Russian industry should now be regarded as seeds sown at the right moment in an economical soil favourable for growth, demanding the blessed rain of government measures, now pouring down upon them, necessary for quick fruit, as appears from the case of the above mentioned rapid development of the Caucasian naphtha industry. It is necessary to bear this consideration always in view on making acquaintance with the descriptions, set forth in this book of the various kinds of Russian manufacture.

Secured with an immense extent of fertile lands capable without extraordinary effort of feeding the people, even if increasing at the most rapid rate possible, possessing the climatic conditions necessary for the yielding of the most various productions of the vegetable and animal kingdoms, containing in her bowels, almost untouched, every possible kind of ore and stone beginning with the most abundant coal beds and ending with inexhaustible stores of scarcely touched native gold, finally as a territory, having in many parts already a dense population and situated midway between even more thickly populated regions of Europe and Asia, Russia as a country enjoying peace and order, determined by the absolute unity of the will and desires of the Emperor and of the whole people, aspiring with all the fire of youth to receive the blessings of enlightenment, has now reached the period at which the already existing germs of manufacturing industry must inevitably develop with tremendous pace.

But as a country of immense extent, Russia exhibits the greatest variety of

conditions for the growth of this kind of economical activity. This is especially true as the first conditions of such a development are density of population, (a scattered people not affording to manufacturing industry the fundamental conditions of a wide development, but only exceptional manufactories and mills), the convenience of ways of communication for the export of surplus products and the import of raw materials, and finally a supply of cheap fuel. But these three conditions are very unevenly distributed in Russia. Therefore, to become acquainted with Russia's industry it is necessary in the first place to enter into its divisions in districts possessing various economical characters. As however the administrative division of Russia into governments and territories, the number of which reaches, inclusive of Finland, ninety-eight, is very minute, it is convenient for the sake of clearness without departing from the administrative division according to which all statistical information is collected, to group all the governments into a few economical regions, whose number shall be limited. Following the most popular system of arrangement and beginning with the two capital industrial districts, a short description of these regions will be put before the reader.

I. THE CENTRAL OR MOSCOW REGION.

This region often bears the name of the Industrial District, because many forms of manufacturing industry were first established there. Herein enter the governments of Moscow, Vladimir, Kaluga, Kostroma, Nizhni-Novgorod, Smolensk, Tver and Yaroslavl. Their total may be classified as follows:

Governments and territories in European Russia proper . .	50
» » » » Finland	8
» » » » Vistula Region	10
» » » » Ciscaucasia and Transcaucasia	12
» » » » Eastern and Western Siberia	9
» » » » Steppe. Central Asiatic and Transcaspien possessions .	9
Total . .	98

The above area covers about 356 thousand square versts, or about 7,360 square geographical miles, or more than the area of Great Britain but less than that of France. The number of inhabitants is about 12 millions. This most densely populated of the primitive Russian regions, although lying in the temperate zone and having long ago developed its agriculture, yet produces less grain than it consumes, and therefore became long ago a manufacturing centre. Here numerous household peasant industries are extremely well developed, and the people are imbued with an ancient trading and industrial spirit, so that the deficiency of agricultural activity is here compensated by the development of enterprise in a greater degree than in many other districts. The Moscovite Princes and Tsars had already planted here many kinds of industry, and this region is to be considered to this day as the most developed in an industrial sense. Here have been concentrated the most important manufactur-

ies of Russia, and many works engaged in the chemical, dye, glass, starch, starch and molasses, machine and founding industries; here are also the centres of all the most important internal, and the majority of the external, especially Asiatic, trading enterprises. The latter are concentrated in the commercial houses of Moscow and in the most important fair in Russia, that of Nizhni-Novgorod, commonly called *Makari-iev*. Compared with the other parts of primitive Russia this district has the largest population.

Agriculture does not here yield great profits, both because of ancient cultivation and the exhaustion of the soil, and because the intensive method of raising grain, most appropriate here, is as yet little known. It is true, however, that here the growing of potatoes, the raising of artificial grasses, hop raising, and the cultivation of aniseed and other commercial plants, have been more developed than in the other parts of Russia. As a consequence of the state of agriculture the mills and manufactories of this district experience no lack of workmen of every kind, both skilled and unskilled, thus aiding to a considerable degree the rapid development of the industry of this district. The railways start from Moscow as from the natural centre and heart of Russia. All these conditions together with the character of its inhabitants make the region described at this day, as was the case in the sixteenth century, the most important district in respect to Russian economical life. Although mining industries are here little developed, the getting of iron, millstones, plaster of Paris, and many other minerals, had already begun in ancient times. These enterprises are, however, now being but slowly developed, although coal veins exist at a certain depth under the whole surface of the district. The coal, which is however not of high quality, crumbling easily and containing a large percentage of ash, is found along the southern edge of the region, in the governments of Tula, Riazan and Kaluga. This local fuel forms only a small part of that which is consumed in the region where wood is everywhere abundant.

In ancient times this region was covered with dense forests, and they are even at the present day abundant in the government of Kostroma, half of which is still covered with wood which is cut principally to supply the lower reaches of the Volga destitute of timber. In the remaining governments of the district the forests still occupy about one-third of the surface, and being more or less regularly renewed they serve not only for the building necessities of the inhabitants and for warming their dwellings, but also for supplying many manufactories, works, engines and steamers. The numerous manufactories and mills of this region, founded long ago and situated in the most populous parts, purchased forests enough to ensure their continued activity. This necessity largely increases the capital required for carrying on manufacture. The purchase of fuel is accordingly effected annually at the proper time, so that the wood may have time to get dry and to be then delivered by the winter sledge roads by the peasants who are then free from rural occupations. In consequence of the relative scarcity of forests the prices of wood fuel are rising considerably in the region; and in the localities most distant from ways of communication they reach, with delivery, not less than 10 to 15 roubles per cubic sagene, by weight about 240 pounds, or 4 tons. The customary cost to manufacturers of wood fuel is, however, already about 20 to 25 roubles per cubic sagene. As a cubic sagene of wood fuel is only equivalent for steam engines to 100 pounds of high quality coal,

at about 20 kopecks a poud. the latter can here easily supplant the use of wood. Good Russian coal is supplied to the Moscow region from the Donets basin, a distance of about eleven hundred versts, and partly from Poland. Coal from the Urals also may be sent thither by the Kama and Volga, while English coal may come from St. Petersburg. Formerly no small number of Moscow manufactories and mills were furnished with the latter, until Moscow was opened to Donets coal by the lowering of the railway rates.

Side by side with wood fuel and with coal from the above regions and from the neighbouring governments of Tula and Riazan, local peat and naphtha residues from Baku are now applied as fuel in large quantities in the Moscow district. The value of peat, in a dried and pressed state as fuel is not inferior to that of wood. As the owners of the works are able to supply themselves with it from the neighbouring localities, in case of an insufficiency of wood they prefer peat, the getting and carriage of which furnish winter wages to the surrounding population. But as peat yields little heat in proportion to its bulk, it does not pay to transport it very far. In this respect naphtha residues possess the excellent quality of containing in a small weight the greatest amount of heat, as 60 to 70 pounds of naphtha residues replace in a steam engine 100 pounds of the best coal, or about 250 pounds of wood, or as much as 300 pounds of dry peat. And as the price of a poud of residues in Baku is not more than 3 to 5 kopecks, and in the reservoirs of Nizhni-Novgorod, whither the residues are forwarded by the Caspian sea and the Volga, about 150 kopecks, they cost in Moscow in the railway cisterns about 21 to 23 kopecks per poud. At this price they compete easily with all other kinds of local and imported fuel in Moscow and vicinity, because the art of employing petroleum waste for all technical purposes, such as the stocking of steam engines, the welding and smelting of all kinds of metals, is already spread over the whole of Russia. At any rate for the industrial development of the Moscow region the question of cheap mineral fuel demands the greatest attention. Its dearness limits the growth at least of those industries which require much fuel.

It is not improbable that coal will be found in the deep strata of the Moscow region, because coal-bearing formations probably lie under the whole of the section, as was already indicated by Murchison. But however serious might become the importance of fuel for the Moscow region, however cheap it might be in some other districts of Russia, as in those of the Donets, the Ural or Poland, Moscow at any rate now concentrates so many enterprising people and forms such an advanced economical centre that it will long remain at the head of the extensive manufacturing development destined for Russia.

II. THE BALTIC AND PETERSBURG REGION.

To this region must be reckoned the governments of Petersburg, Novgorod, Pskov, Courland, Livonia and Esthonia. The extent, namely, 277 thousand square versts, or about 5,717 square geographical miles, is only one-quarter less than that of the first region, but the number of inhabitants, about six millions, is but half as great, because of the scant fertility of the soil. From the earliest times Novgorod and

Pskov of old, and St. Petersburg, Riga, Reval and the present Baltic provinces have served as trade routes for communications with Western Europe. As a consequence the spirit of enterprise has long been here developed, leading to the establishment of many industrial undertakings, among which the manufacturing, chemical, metal and wood industries have acquired a most substantial position. But even now trade and agriculture, the latter developed here and there in more intensive forms than in any other parts of Russia, play in these regions an economic role incomparably greater than manufacture. This circumstance is explained by the presence of water ways of communication, alike connecting with the interior of the Empire, especially by the Neva and the systems uniting Lake Ladoga and the Volga and with Western Europe, St.-Petersburg as the capital and the key to these water ways, possesses many manufactories and mills of every kind, but the surrounding country contains but few of them, some parts of it, especially in the Novgorod government, are sparsely populated and filled with forest swamps.

In the Petersburg and Novgorod governments about 40 per cent of the surface is still covered with forests; in Esthonia and Livonia, about 25 per cent; in the remaining provinces, 30 per cent, so that there is here abundance of wood for fuel and the latter is about 70 per cent cheaper there than in the Moscow region. Nevertheless there is brought hither principally from England, for the purposes of the works, manufactories, steamers and steam engines, about 70,000,000 pouds or 1,200,000 tons of coal annually, at a cost on the spot of 16 to 17 kopecks per poud.

III. THE FINLAND REGION.

The Grand Duchy forms a perfectly independent administrative region and is also separated from the other parts of the Empire in an economical respect, even possessing its own customs tariff. Its area, 328 thousand square versts, or 6,783 square geographical miles, is almost equal to that of the Moscow region, but the number of its inhabitants, about two and one-half millions, is 20 per cent thereof, sufficiently explaining the feeble development here of manufactories and mills. The principal industries of the country consist in agriculture, cattle raising, the felling and fashioning of timber, and the quarrying of stone. Cast iron and iron are obtained to the amount of about one million pouds, while numerous but small and various manufactories and works produce goods to the value of some 40 million roubles yearly.

The chief industries are spinning and weaving, wood, metals, butter and leather, paper, papier-mâché and pottery. The export of these goods into other parts of Russia reached 13 million roubles in 1890, while the import to Finland, principally grain, reaches 17 million roubles in the same year. Finland's foreign trade consists principally of timber and butter. The quantity of forest, some 42 per cent of the surface of the country, combined with the scanty population, makes it possible for Finland to develop her industry on a basis of wood fuel.

IV. THE NORTHERN REGION OF EUROPEAN RUSSIA.

This comprises the governments of Olonets, Archangel and Vologda, limited on the north by the Arctic ocean, and bordered on the south by the Moscow and Baltic

regions; it is, over the greater part of its surface, not suited to the profitable cultivation of grain, and therefore, notwithstanding its immense extent, about 1,240,000 square versts, or 25,608 square geographical miles, is most thinly populated, counting but two million inhabitants. This region then, although it has an abundance of wood fuel, is very unproductive in respect to manufactories; but the country deals in timber and in the products of its dry distillation. It is occupied, moreover, in its southern parts with agriculture, grain and flax, cattle raising and also fisheries. Only in the Olonets government, where iron and copper ores have been known from ancient times, are metallurgical operations at all developed, and there feebly. In the course of time, in consequence of the convenient water communication with St. Petersburg, it may be possible to bring to life again this region inhabited by a people which retain to this day their ancient Russian customs and a completely patriarchal mode of life.

V. THE EASTERN REGION OF EUROPEAN RUSSIA.

It borders on the Ural and the Volga and is composed of the governments of Viatka, Kazan, Ufa. Orenburg, Perm and Samara. This immense district which has been Russian territory only since the sixteenth century, but has become completely russified by emigrations begun already by the inhabitants of Novgorod in the most ancient times, contains 891,000 square versts, or 18,404 square geographical miles, and about 15 million inhabitants. The latter have settled here on account of the favourable local conditions. Part of this country consists of fertile black-lands passing in the south-east into steppes and in the north, into a forest region. On the east it borders on the ore-bearing Urals, on the west it is bounded by the Volga which opens, with the aid of the Kama and its tributaries, an easy communication to the whole region with the remaining parts of Russia. This eastern district is twice as scantily populated as the central region, but much more fertile than the latter and containing various kinds of mineral wealth, such as gold, salt, coal, iron and copper, and is acquiring an ever-increasing importance from an economical point of view, although in consequence of the felling of the forests which existed in the neighbourhood of the iron works of the Urals, the former importance of these works, as the furnisher of the most excellent iron for all Russia and for foreign export, especially in the form of very soft sheet iron, has considerably lessened in the last few decades. The cause of this fact must be sought, first of all, in the unsatisfactory condition of the forest economy upon those vast areas which are ascribed to the private and Government works of the Urals, and to the absence of such laws in reference to the right of using minerals which would secure the possibility of a sufficiently wide competition in the treatment of the ores of the given locality.

With the construction of the great Siberian Railway, with the increased working of the Ural coal mines, already long ago begun, and with the division of the ore-bearing estates into smaller parcels than at present, a rapid development may be again expected for the mining industry, the more so as there are here many persons well acquainted with its details. All the preceding districts import grain, but this produces an abundance of cereals in its southern and Chernoziom regions, so that in good years, namely those free from drought, it not only furnishes the less pro-

ductive north-eastern parts of the immense district with grain, but sends its cereals also up the Volga.

Taking into consideration the total amount of its mining and manufacturing industry the eastern district must be reckoned among the most important in Russia. The getting of gold, iron, copper and coal is concentrated in the eastern parts of the district, adjacent to the Urals. Many works are situated upon the Kama and its affluents, even to Kazan. Specially deserving of attention are the metal works, and those engaged in casting cannon and in the manufacture of arms, as well as those occupied in transforming pyrites and salt into various chemicals.

The southern part of the region, passing into steppe, is little wooded, in the Orenburg government only 15 per cent, in Samara only 8 per cent is covered with forest, and consequently suffers from a lack of fuel. The northern and eastern parts on the other hand are still rich in forest. Viatka has 61 per cent, Kazan 36, Perm 75, and Ufa 42 per cent of wooded surface. Add to this the supplies of coal in the Ural and the convenience of the water communication for obtaining naphtha waste from Baku and no difficulties are to be expected in obtaining fuel for the extensive development in this region of every kind of manufacturing industry. A beginning has been already made and the enterprising spirit of the Russian inhabitants of this district, forming as it does the bond between the Moscow or Central district and Siberia, is calculated to still further help it forward. This district should be regarded as the window giving industrial light to the Asiatic coast.

VI. THE SIBERIAN REGION.

Siberia, or the northern part of Asia, stretches from the west to the east, from the Urals to the Pacific ocean, and from the Arctic on the north to the frontiers of Korea, China and the Kirghiz steppes, of the following seventh district, on the south. It comprises the governments of Tobolsk, Tomsk, Yenisseisk. (chief town Krasnoyarsk) and Irkutsk, the Territories of Amour, the Seacoast government, Yakutsk, Transbaikal and the island of Sakhalin. Its total area, about 11,000 thousand square versts, or 227,000 geographical miles, almost thrice exceeds European Russia without the Caucasian governments, and is much more extensive than the United States of America. Upon this vast territory there live only about five million souls, although the southern parts of the country abound in all the gifts of nature, beginning with a wealth of rivers, forests and fertile lands and ending with that abundance of mineral wealth which led to the saying: *Siberia is a golden well*. These parts of Siberia form a great reserve for the migration of the multiplying Russian people, even if half of the area of Siberia be completely excluded, a region occupied by bleak wastes, adjacent to the Arctic ocean. Unacquainted with wars and never having known the dependence of serfdom, Siberia was yet for a long time an object of terror from the rumours that circulated about it. But little by little prejudice is being removed.

With the completion of the Great Siberian Railway already begun, and with the abolition of the transportation of convicts. Siberia will not only serve by its extensive lands as a grower of grain, but by its mineral wealth will be the furnisher of metals, among which until now gold is obtained, it alone bearing a long transport by land to the exclusion of almost all other metals. The rich coal veins of the

Kusnetsk district and other parts of Siberia, together with its inexhaustible forests of cedars and other valuable trees mainly belonging to the fir family, give abundant security for the development of every possible kind of works and manufactories, steamers and railways.

At the present time the whole manufacturing industry of Siberia, apart from the extraction of gold, is confined to a few undertakings for the obtaining of goods, such as iron, leather, glass, spirit, salt, cloth and vegetable oils, destined almost exclusively for local consumption and for a limited export to the Kirghiz steppes and to European Russia. Hither, too, are carried by way of Siberia tea and other Chinese wares, and thence by the water systems of the Volga and Kama, the Tobol and the Obi, return goods of the most various description, beginning with manufactures of many kinds, and ending with spices. The Ministry of Finance desiring to assist in the spread of trustworthy information about Siberia has undertaken the publication of a special description of this vast territory of the Empire for the World Columbian's Exposition.

VII. THE CENTRAL ASIATIC REGION.

This region bordering on Siberia on the north-east, touching the southern parts of the governments of Tobolsk and Tomsk, on the north-west, the eastern portion of European Russia, namely Orenburg and Ufa, is bounded on the east by the government of Astrakhan and the Caspian Sea, on the south-west by Persia, on the south by Afghanistan and on the south-east by China, coming also into contact in the south with Khiva and Bokhara. This region includes the Kirghiz steppes and the comparatively recently annexed Central Asiatic dominions, possessing an Asiatic population among whom emigrants from purely Russian districts have latterly commenced colonising, thus forming in many places an unbroken Russian population. Among such localities must be reckoned beginning from the north and east, the territories of Semipalatinsk (chief town, Semipalatinsk), Semiretchiusk (chief town, Vierny), Akmolinsk (chief towns, Omsk and Akmolinsk), Turgaisk (chief town, Turgai), Uralsk (chief town, Uralsk), Samarkand, (chief town, Samarkand), Fergan (chief town, Margellan), Transcaspian, (chief town, Askhabad) and Syr-Daria (chief towns, Tashkend and Petro-Alexandrovsk). The area is about 3,080,000 square versts or 63,637 square geographical miles; the population, about six millions.

A considerable part of the inhabitants are nomads, Kirghiz and Turkmen, living still in a pastoral condition asking for almost nothing from manufacturing industry and providing it on their part only with wool, tallow, felt, and leather. But in the warm valleys of the southern parts of the region live tribes having fixed habitations, of the Bokharian type, actively occupied with agriculture and producing not only the grain and fruits of temperate countries, but also rice, cotton, every description of fruit, and together with the Russian settlers already representing a demand for many kinds of manufactures, and furnishing in their turn a mass of materials for manufacture, beginning with the products of ores and ending with cotton and wine. There can be no doubt but that the Russian dominion in these countries is tending to their rapid economical growth, and that the industry here springing up is developing very fast, being greatly assisted by the Transcaspian

Railway, whose construction from the Caspian Sea into the heart of the southern part of the Central Asiatic district was projected at first with purely strategical objects, to overcome the sandy deserts surrounding the highly favoured regions of the slopes of the vast Central Asiatic mountain ranges.

The average condition of the district must be called steppe and woodless, and therefore the lack of fuel is very much felt in the case of all industrial undertakings. However coal has already been found in some places, as also naphtha, while the comparative nearness of Baku with its abundant supply of liquid fuel and the easy delivery of the latter by sea and by the Transcaspian Railway help out even the pioneers. It is impossible not to point out that the fisheries, especially of the Ural territory, the naphtha springs found in various parts of the steppe, the richest deposits of native sulphur, cropping out almost on the very surface among the sands of the Kara-Kum, the most various ores discovered both in the Kirghiz steppes and in Turkestan, and the rapid development of ease and industry in the region, in some places so richly endowed by nature, furnish a guarantee that here is being formed a centre for the quick development in an economical sense of all the peoples of Central Asia, which again is greatly assisted by the friendly spirit and the tranquility introduced with the annexation to Russia.

To show how rapidly the desired development is proceeding here it is sufficient to say that the chief town of the territory of Semiretchinsk, Vierny, situated 43° 16' N., and 79° 59' E., already counts twenty-two thousand inhabitants and is surrounded by many Russian settlements, although the whole of this Transilian region has been occupied by Russians only since 1853, and the first stones of the fortress were laid in 1854. At any rate the southern parts of the described territory, simply because they are capable of growing cotton, jute, indigo and similar products, present a great importance from the point of view of trade and industry, as these articles are now engaging the attention both of the local inhabitants and of Moscow industrial circles, with every assistance from the government.

VIII. THE CAUCASUS.

This region reckoning all the possessions lying between the Black and Caspian seas, namely Transcaucasia, the Black sea district, the government of Stavropol and the territories of the Kuban cossacks on the west, and of those of the Terek on the east, occupies a surface of 415,000 square versts, or 8,580 square geographical miles, and has a population of about 8,000,000 inhabitants. With the cessation of hostilities in the Caucasus about 1865 the extremely rich region began to develop rapidly, not only in all other matters of civilisation but also in respect to the growth of manufacturing and mining enterprises. To confirm this statement it is sufficient to mention the development of the production in this region of petroleum, copper, coal, rock salt, Glauber's salt and sulphur. And as not only the obtaining of ores, especially of manganese, the usual grain growing and cattle raising, silk growing, wine making and the cultivation of all kinds of plants from hot countries, including among the latter the cotton plant, have already taken deep root in the region and as ores of lead and zinc have been discovered and even begun to be worked with increased efforts this district is capable of occupying an extremely prominent position in the

mining and manufacturing development of Russia. The chief obstacles to this at present are the incomplete limitation of private estates in many parts of the district, the scarcity of forests in many places and the lack of branch lines to the chief railways which traverse the country from the northern and southern slopes of the range of the Caucasus. And yet the further rapid development of the manufacturing activity of the Caucasus may be looked forward to in the near future, because its happy situation between two seas and the magnificent conditions of climate and soil of many parts of the region, as well as the measures being taken by the Government in aid of its economical development, are drawing to it the general attention of all Russia, more so than is the case with many other outlying regions of the Empire. At the same time the local population itself is displaying evident tendencies to a development of trade and industry, the more so as among this local population the Georgians, Armenians and Persians in Baku have an obvious bent to both these forms of activity.

IX. THE SOUTHERN REGION OF EUROPEAN RUSSIA, ADJACENT TO THE CASPIAN, AZOV AND BLACK SEAS.

This region comprises the territory of the Don and the governments of Astrakhan. Ekaterinoslav, Tauris or the Crimea, Kherson and Bessarabia. The chief towns are Novoherkassk. Astrakhan. Ekaterinoslav. Simferopol, Kherson, Odessa and Kishiniov. In the most part these are fertile steppes, capable of a high agricultural cultivation. Only in the south of the Crimea are they traversed by the projection of a low mountain ridge, and in Bessarabia, by mountains of inconsiderable elevation, often regarded as the last spurs of the Carpathians. The only importance, however, is possessed by that granite bed which defines the rapids of the Dnieper and the outcrop of coal measures and every kind of ore in the region of the Donets. In the whole of this district, which a hundred years ago was still almost a desert, at the present day a population of ten million inhabitants must be reckoned, settled upon 566 thousand square versts, or 11,710 square geographical miles. Contiguity with the seas and the abundance of the steppes, watered by numerous rivers, beginning with the Volga, Don and Donets and ending with the Dnieper and Dniester, have always attracted thither emigrants from other parts of Russia and from other countries, led to the formation of Cossack and Colonist settlements and to the transference thither of whole villages from other parts of Russia, as occurred in the end of the last and the beginning of the present century. Hence it is that the greater part of this region often even to-day bears the name of Novorossia (New Russia).

Having become Russian, this country, especially the shores of the Azov and Black seas, attracted trade, and Rostov, Taganrog and Odessa became the centres of the foreign grain trade. The industrial development, which began here in the thirties, shows great promise, especially in connection with the rich and extensive coal measures of the Donets region. Rock salt, pyrites, the richest beds of iron ores, such as exist at Krivoi Rog, Korsak-Mogila and other places, as also ores of copper, zinc, mercury, silver, lead and manganese, the abundance of most excellent fire clays and various other kinds of minerals lying in the neighbourhood of the coal measures, define both

the contemporary mining and manufacturing importance of this region, and the extent of its further industrial importance in the future, which is particularly favoured by the fertility of the surface and the existence of numerous rivers, communicating with the centre of Russia and with the export harbours.

Wine making, silk growing and the raising of all kinds of fruits are here developed side by side with forestry, which is destined to moderate the extreme contrasts of climate in this southern steppe zone of Russia in which woods now constitute a great rarity. In a word, this is the region of the country which is destined to show, with the Caucasus, the greatest industrial future, especially in consequence of the nearness of the Black Sea.

X. THE SOUTH-WESTERN REGION.

This region comprises the governments of Podolia. (chief town Kamenets-Podolsk), Volynia. (chief town, Zhitomir) and Kiev. (chief town, Kiev), and forms the natural transition from the previous district, in particular Bessarabia and Kherson and from the Austrian possessions of Galicia, on the one hand to Little Russia proper or the Thirteenth Region, through the marshy parts of the forest region of Volynia to the north-western districts of the Twelfth Region, and on the other hand to the Polish governments of Russia. It contains the oldest of Russian towns, Kiev, which was the first capital of ancient Russia. This region, with 145 thousand square versts, or 2,993 square geographical miles of surface, and more than 8 million inhabitants, and distinguished by the flourishing condition of its agriculture, has already begun its mining and manufacturing activity, expressed both in the exploitation of many minerals, such as brown coal or lignite, labrador, phosphate rocks, and iron ores, and by the development of beet sugar manufactories, with its comparatively dense population, may play its part in the coming development of Russia's industrial forces, to which however there are obstacles in the absence of an abundant supply of mineral fuel of its own and in the felling of the former extensive forests.

XI. THE VISTULA OR POLISH REGION.

This region comprises the governments of the former kingdom of Poland, which passed to Russia, and with an area of 112,000 square versts, or 2,312 square geographical miles, has a population of about 9 million, being thus more thickly inhabited than any other part whatever of Russia. The chief branch of the economical activity of the inhabitants, as also of the whole Russian people, is agriculture and the industries related thereto, such as beet sugar manufacture and distilling. But as this region is rich in coal, as in the government of Petrokov, and has a denser population than that of the other parts of Russia, and in consequence of its proximity to the industrially developed parts of Western Europe, namely Prussia and Austria, it is more deeply imbued with the industrial spirit than the remaining districts of the Empire; and since Russia in the latter decades began to foster, with the help of a protective customs tariff the development of its internal industry, it has rapidly developed its mining and manufacturing activity. This movement was very strongly marked in the rapid growth of the getting of coal (See Mining Industry), and the production

of cast iron, iron, steel and zinc, and in the flourishing condition of the production of cotton and woollen fabrics. The productions of these and many other Polish manufactories and mills find a growing market throughout all Russia. By means of the competition of this industrial centre with the Moscow industrial region are attained, on the one hand, the fundamental object of Russia's protective policy, and on the other, that union of Poland with Russia which answers to the peaceful aims of the Russian people. But as the Polish coal is little adapted to the production of the coke required in metallurgical operations, which is easily obtained from the coal of the western Donets, and the mineral wealth of the region is limited, while the distance from the centres of sale especially from the east of Russia is great, it follows that to maintain her industrial growth Poland must constantly busy itself with the technical improvements of its manufacturing industries, which is indeed seen to be the case.

XII. THE NORTH-WESTERN REGION.

This region contains White Russia and Lithuania, that is, comprises the governments of Vilno, Vitebsk, Grodno, Kovno, Minsk and Moghiliou, a part of which formed the ancient principality of Lithuania, which once struggled for independence with the Teutonic knights, and entered into alliance at one time with the Russian tsars, at another with the Polish kings, and was then united to the Empire. This forms in every respect the transition from the former to the two central and Baltic regions. The surface of this district, 269 thousand square versts, or 5,563 square geographical miles, is devoid of mountainous elevations, contains the vast marshy forest tract called Polesie, and is still rich in woods, which cover about one-third of its area. Its inhabitants, numbering about 9 millions, are almost exclusively occupied with agricultural pursuits, so that here, as in the following district, manufacturing is only in embryo, satisfying principally local needs which are being but little developed and gravitates in industrial respects to the Moscow, Baltic and Polish districts, as centres of manufacturing activity.

There is almost no mining industry whatever in the whole of this region.

XIII THE LITTLE RUSSIAN REGION.

This region contains thickly populated governments stretching from the west to the east and separating New Russia (Region IX) from the central grain producing governments (Region XIV). The Little Russians or Cossacks of olden times (*Khokhly*, *tufts*, as they are called by the common people), inhabit not only the governments of Chernigov, Poltava and Kharkov which form the region described, but also many localities in the neighbouring districts, especially in the South-western Region. In the seventeenth and eighteenth centuries it was here that was concentrated the activity of those primitive Russians, who once formed Russia's bulwork against the attacks of the Turks, principally by way of the Crimea, and against the Poles. Once a population of warriors to a man, the Little Russians have long become converted into veritable farmers, thanks to the fertility of the plain occupied by them. The surface of the district, 138 thousand square versts, or 2,846 square geographical miles, is fairly populated, there being between seven and eight million inhabitants, almost

indeed as much so as the South-western Region. Compared with the latter it is poor in minerals but richer than the two preceding regions in black-earth soil. On account of this and from the disposition of the inhabitants, and from the want of fuel of its own, forests here forming but ten per cent of the surface, manufacturing industry is here very slightly developed.

XIV. THE CENTRAL GRAIN OR CHERNOZIOM REGION.

This region occupies a vast area, 414 thousand square versts, or 8,560 square geographical miles, situated to the south and south-west of the Central Moscow Region, and to the north and east of Little Russia. Here the Chernoziom predominates, although not uninterruptedly over the whole district, and the fertility of its plains attracted hither from ancient times a mass of Russian folk who are agricultural in their former and in their present mode of life. In this district are to be included the gov-

T A B L E 5.

REGIONS OF THE RUSSIAN EMPIRE.	Sq. geog. miles.	Millions of inhabitants.	Inhabitants per sq. geog. mile.	Yield of grain and breadstuffs in millions of pouds.			Annual production of spirit in millions of vedros, absolute alcohol.	Production of cast iron in millions of pouds.
				Oats.	Foodsuffs.	+ surplus. - deficit.		
I. Moscow Central	7,360	12	1,630	51	123	- 27	1.7	3.3
II. Baltic-Petersburg	5,720	6	1,040	26	59	- 16	4.7	—
III. Finland	6,780	2.5	370	14	28	- 3	0.2	1.4
IV. Northern	25,610	2	80	7	16	- 9	0.2	0.1
V. Eastern	18,400	15	820	86	263	+ 76	2.2	27.7
VI. Siberia	227,000	5	22	Official information on harvests does not exist.			1.1	0.4
VII. Central Asiatic	63,640	6	94				0.1	—
VIII. Caucasus	8,580	8	930				0.9	—
IX. Southern	11,710	10	850	15	227	+102	1.0	13.2
X. South-western	2,990	8	2,670	28	124	+ 24	3.5	0.2
XI. Polish	2,310	9	3,890	30	107	- 6	3.2	7.8
XII. North-western	5,560	9	1,620	22	86	- 27	2.7	—
XIII. Little Russia	2,850	7.5	2,640	17	109	+ 15	2.2	—
XIV. Central Chernoziom.	8,560	19	2,220	123	384	+146	8.3	2.5
	397,070	119	300	359	1,526	+275	32	56.6

ernments of Tula, Oriol, Riazan, Kursk, Tambov, Penza, Saratov, Simbirsk, and Voronezh. The number of inhabitants of this district, about fifteen millions, making 46 to the square verst, is greater than in the Central Moscow Region, with 34 to the square verst, and forms the transition to the districts of Little Russia, 54 inhabitants to the square verst, and Poland, 80 to the square verst.

Agriculture alone has here already long become insufficient for the economical activity of the country, the more so as agriculture is here to this day carried on mainly on extensive farms, of such a pronounced character that in many places dressing with manure is only applied on hemp fields, while the lands, from ancient cultivation under grain, have already considerably exhausted their original fertility. For this reason migration into other districts with a more thinly settled population proceeds mainly from this and the Little Russian districts. But in contradistinction to the latter, there is here evident the beginning of various forms of manufacturing activity, assisted even now by the extensive forests of certain localities, for example, the governments of Oriol and Riazan. In general, however, this district is not

TABLE 5.

Number of manufacto- ries and mills not pay- ing excise.	Annual production of manufactories and mills, in mil- lions of paper roubles.			Production of all manufactories and mills, being total of 8, 9, 10.		Production of grain breadstuffs per inhab- itant	Principal arti- cles produced by the Region.	Development of export trade.	Region.
	Of those in column 7.	Subject to excise.	Mining.	Total, million roubles.	Per inhab- itant.				
3,750	417.2	29.8	13.1	460	r. 38	r. 10	{ Manufactured, metallic and other goods.	Considerable Internal and Asiatic.	I
1,654	183.3	44.9	13.5	242	40	10		Considerable Internal and West European.	II
4,884	36.8	6.5	2.9	46	18	12	Wooden articles.	Feeble foreign.	III
198	6.2	0.7	0.2	7	3.5	8	Timber, flax.	Feeble.	IV
1,901	53.0	10.0	51.5	114	8	15	Metals, grain.	Internal.	V
684	7.5	3.3	37.0	48	10	—	Gold, animal products.	Feeble.	VI
388	12.8	0.5	0.8	14	2.3	—	Cotton, animal products.	Feeble.	VII
915	19.8	16.3	17.9	54	7	—	Wine, naphtha, grain, copper.	{ Internal and foreign.	VIII
2,559	52.0	25.6	41.9	120	12	19	Coal, grain.		IX
1,002	21.1	36.9	0.2	58	7	14	Grain, sugar.	Feeble.	X
2,354	155.6	33.8	20.9	210	23	11	Manufactures, metals goods.	Internal.	XI
1,214	23.8	15.6	0.0	39	4	9	Timber.	Feeble.	XII
767	19.1	30.4	0.2	50	7	13	Grain, sugar.	Internal grain.	XIII
4,325	92.6	34.0	8.0	135	7	19	Grain, spirit.		XIV
26,595	1,100	289	208	1,597	Average 13.5 14				

thickly wooded, the proportion of forest varying from 9 to 23 per cent for different governments, while in some parts it is insignificantly small. Further, in the governments of Tula and Riazan coal measures have been found. From the earliest times the manufacture of various articles from iron and copper has been firmly established in Tula, such as, guns and samovars, used throughout Russia, and domestic implements.

In the Briansk forests of the Oriol government glass blowing, woodwork, the manufacture of machinery and other industries have sprung up, whose development in the so-called Maltsev district has acquired notoriety over all Russia. The distilling of alcohol, the beet sugar and many other branches of manufacturing industry here have all the necessary conditions for prosperity, and on the whole this district from its comparative populousness and central position, and from the discovery of local coal, must naturally by degrees pass over from a purely grain-growing activity to such a form of the combination of agriculture with manufactures as now already corresponds to the majority of the more densely inhabited districts of Russia, and which till now was to a certain extent observed by the Central Moscow Region alone.

The above enumerated regions of the Empire are entered in the annexed map which indicates the degree of development in them of manufacturing industries.

In order to still more closely characterize the industrial activity and mutual relation of the above indicated fourteen regions of the Russian Empire in the table given below, each Region has been shown in separate columns: 1. the area in square geographical miles (1 square geographical mile equals 48.38 square verstes, equals 55.06 square kilometres, equals 21.25 square English miles); 2. the number of inhabitants; 3. the density of the population, or the number of inhabitants to one square geographical mile; 4. the quantity of grain obtained per annum, distinguishing *a.* oats, as a grain grown throughout Russia principally as feed for horses; *b.* the total amount of breadstuffs going to feed the population: rye, wheat, barley, peas, maize, millet, buckwheat; *c.* the surplus or deficiency of the same; 5. the quantity of spirit distilled per annum, both from grain and from grapes, in vedros (1 vedro = 12.299 litres = 2.707 gallons) of absolute alcohol, which is a well known measure of the development in various regions of the manufacturing treatment of agricultural products; 6. the quantity in millions of ponds of cast iron, produced in the district in 1890, as a measure of the development in various districts of metallurgical works; 7. the number of manufactories and mills, excepting mining works and those which are subject to excise, registered in the reports of the Department of Trade and Manufactures; 8. the amount of the annual output of all the manufactories indicated in the preceding column, entered according to the declarations of the owners, in millions of roubles; 9. the amount of the output of the manufactories, subject to excise, distilleries, breweries, sugar bakeries, tobacco manufactories, petroleum refineries and match works, reckoning on an average without excise but with by-products, spirit at 2 roubles¹, beer and mead at 1.50 roubles a vedro, sugar at 5 roubles a pound of refined,

¹ The values cited further on are expressed in paper roubles and represent the average fabric prices at the places of their production, including by-products not subject to excise. Thus, the price of spirit is about one rouble and a half, but as the malt grains produced

tobacco at an average of 30 roubles a pound for the higher qualities and 7 roubles for the lowest, or *makhorka*, and matches at 58 roubles a million, and 15 kopecks a pound for all illuminating and lubricating products of the distillation of petroleum (account is taken of raw naphtha in the amount of next column); 10. the amount of the output of the manufacturing and mining industries, under the purview of the Mining Department, reckoning a pound of gold direct from the mine at 20,000 roubles, a pound of silver, 1,100 roubles, copper 10 roubles, and zinc 4 roubles. cast iron. 50 kopecks, hardware made from same 1.50 roubles, iron and steel in rails, strips and sheets, at 1.50 to 2.25 roubles¹, iron goods at 4 roubles a pound, coal at 6 kopecks, salt at 7 kopecks, naphtha at 5 kopecks a pound², asphalt and *kir* at 15 kopecks a pound, sulphur at 1 rouble a pound, manganese ores at 40 kopecks a pound and phosphate rocks at 15 kopecks a pound; 11. the total of the amounts in the last three columns.

THE FOLLOWING REMARKS ARE IN EXPLANATION OF THE FACTS
AND FIGURES CONTAINED IN THE TABLES.

In reference to the statistics of population it must be observed that as there has been no general census of the population in Russia since the fifties, the number of the inhabitants is only known approximately, being determined from the birth and death rates, and in general deduced from considerations which are subject to some question. On this ground there may be an error in the statistics of population reaching and even exceeding 5 per cent. Therefore, both in the case of the number of inhabitants, and the density of the population, as in column 3. only round numbers are used. These are founded upon the most trustworthy calculations, and include the population down to 1890.

Under the designation of breadstuffs are understood rye, wheat, millet, barley, peas, buckwheat, spelt and maize. The data for their yields, after deduction of seed were obtained in the Department of Agriculture from D. P. Semenov and constitute the average yield for the five years 1883 to 1887. The figures referring to oats are

thereby, together with the casks, cost not less than 50 kopecks, it is valued at 2 roubles per vedro. These values certainly vary according to the quality of the products, the years and the places of production, but the total value of the production is given here in order to show, although partly and conditionally, the relative development of the yield of excise products in different localities.

¹ Taking into consideration that not less than one and one-fifth pounds of cast iron are expended on a pound of steel and iron, and subtracting the value of cast iron, the production of iron and steel in strips, rails et cetera, must be reckoned at about 90 kopecks, and in sheets, at about 1.80 roubles.

² Although a pound of naphtha in Baku is at present estimated at not more than 2 kopecks, naphtha residues into which at present the principal mass of naphtha is transferred, cost about 3 to 6 kopecks; and as the account of the production of kerosene, among the products subject to excise, includes only lighting oils the value of the other products of naphtha distillation is estimated approximately, counting a pound of raw naphtha at 5 kopecks.

placed separately because this grain is almost exclusively used as feed for cattle. The calculation of the excess (+) or deficit (—) of breadstuffs has been made upon the basis of the hypothesis justified by many data that the yearly proportion of such breadstuffs per inhabitant of Russia may be assumed on an average as equal to 12.5 pounds, about 205 kilograms or about 451 English pounds, reckoning under this quantity also the various collateral applications of the same, which are, however, comparatively limited.

The number of manufactories and works given in the seventh column is taken from data supplied by the Department of Trade and Manufactures. In this calculation, in the case of all governments excepting Finland, no account is taken of printing and lithographing shops, nor of bakeries, wine making, nor of small household or artisans shops and works. Furthermore, from these figures are excluded distilleries, sugar bakeries and refineries, tobacco, kerosene and match manufactories and all mining works. Thus, the figures of this column designate only the statistics for the more considerable industrial undertakings, except mining and those subject to excise. A list by name of the majority of the manufactories is published in the form of a book by Mr. Orlov: «Index to the Manufactories and Mills», 1893.

The manufactories subject to excise are distilleries, manufactories of vodka, yeast, raw sugar, refined sugar, petroleum and kerosene, tobacco and matches. Their output is very accurately known, but only in terms of the quantity of their productions, not their value. For the sake of giving uniformity and summariness to the data, characterizing the industrial activity of the various parts of the Empire, this production should be translated into roubles, employing those average prices which are given in the text, where also are included, whenever possible, the value of collateral products. The excise dues are not included in the value of the products; they reached in 1890, 333,000,000 roubles.

Column 10 includes not only the getting of metals, as in Table 3, coal and salt, but also sulphur and naphtha, as shown in the notes explaining the tables. Although the comparative magnitude of the amounts, given in columns 11 and 12, shows the degree of development of industry in different parts of Russia, these figures do not exhaust the whole mining and manufacturing production of the country, not only because not all the manufactories and works are subject to effective registration as was observed above, but also because the valuation of the production in each case itself suffers from various defects. A near idea of the magnitude of the industrial development, with the exception of mining works and manufactures paying excise, which are here given with all possible accuracy, is to be obtained from the figures of the eighteenth column of the next table, because they are determined according to declarations verified by the local courts of taxation with the participation of the producers themselves. The data for Finland are borrowed from the official publication, *Statistisk Årsbok för Finland* 1889 and 1890, but the information upon industry for this district refers to 1886 to 1888. The statistics of the harvest belong to 1887, which was particularly plentiful in Finland. Hence depends the circumstance that the deficiency of grain in Finland (3 million pounds) appears below the ordinary import of that article into the country, namely, about 5 to 6 million pounds. It is known that the north and south of the Caucasus and the western part of Siberia export grain, while the Central Asiatic Region is satisfied with its own

grain, a part even being exported. Hence the total surplus of breadstuffs in Russia in years with average harvests is more than that which is given in the total of the fourth column of the table. The harvest for the Polish region is taken as the average of the combined information for 1889 to 1891, obtained together with other data as indicated above. The average harvest of oats being 359 million pounds, Russia sends abroad on an average about 56 million pounds, which shews a consumption of about three pounds per inhabitant. Oats in Russia are mainly used as feed for horses.

The average surplus of 275 million pounds of breadstuffs obtained in years of average yield, such as were the years 1883 to 1887, corresponds to the average export across the European frontier, not counting the Caucasus, which is given by the customs accounts for 1884 to 1888, by which the relative justice of the method of calculation here adopted is proved. At any rate it is indisputable that the regions I, II, III, IV and XII do not produce a sufficient quantity of grain, while the regions V (the Eastern), IX (the Southern) and XIV (the Middle Chernoziom) in general furnish with their surpluses not only the other regions of Russia, but also many regions of Western Europe, especially Germany and Great Britain. Although the regions I, II and XI show a development of industry combined with a deficit of grain, and therein resemble the countries of Western Europe, yet the Eastern (V) and Southern (IX) regions present a simultaneous development both of the grain, industrial production, of which many other regions of Russia are capable, and especially the Caucasus.

The total amount of the manufacturing production of Russia in 1890 given in the table, 1,597 million roubles, differs from that given on page VII, 1,656 million roubles, principally in this, that in the case of industries subject to excise, sugar, tobacco, beer, spirit and matches, the values are quoted with excise duties. This was done because it was impossible for the preceding years to completely separate the excise upon these articles, to judge from official data, while for 1890 it was possible. In the case again of the products of the naphtha industry, average values taken over several years were quoted, while for the account of the year 1890 the average prices of that year were taken, which are lower than those in the preceding years; at any rate from the difference in the figures upon which they are based the possibility of a greater error must be admitted. As a consequence the figures given in the table must be regarded as only approximate and intended to give an idea of the economic activity of different regions of Russia. Thus, for example, in the table it is clear, that the value of the produce of grain in the Central Region (I) is several times less than that of the products of manufacturing industry, the same appearing to be the case for the regions II and XI, while in the case of the Little Russian and Central Chernoziom regions (XIII and XIV) the reverse holds good. The value of the grain is higher than the value of the products of the manufacturing factories and mills. To this last category belongs the majority of the remaining regions, even the Eastern and the Southern.

By the figures of the last column an effort is made to express the value of the breadstuffs produced in the Region per capita, assuming by a convention the value of a pound of oats at 50 kopecks and the average value of a pound of breadstuffs as 80 kopecks. It thus appears that only in the Central Chernoziom Region and in the

Southern do they amount to 19 roubles per capita, while the average yield of grain to each inhabitant of Russia reaches 14 roubles a year, nearly equalling the value of the production of the manufactories and mills, although in different regions the differences are very sensible. The greatest industrial development, however, combined with export of grain is attained above all in the Eastern and Southern regions, supplying grain and metals to the other regions of Russia, and so proving that the desired combination of agricultural with manufacturing and mining activity is both natural and possible. The highest amount of production falling per inhabitant is however to be clearly found in the two metropolitan regions (I and II) and the Polish (XI) where manufacturing, and not grain growing industries, predominates.

In the above mentioned reports of various Government organs there are no data upon many important industries, for example, wines, wood charcoal, tar obtained by the peasants in the woods, carts, harness, bricks and a number of household products. Moreover, generally speaking, the collection of statistical data, touching various branches of industry, with the exception of those which are subject to excise dues, is not yet carried out systematically. For these reasons the figures set forth in columns, 7, 8 and 11, must be regarded as merely approximate and relative in value. Their relative magnitude, however, nevertheless characterizes the degree of industrial development of the various districts of Russia. In completion of this characterization, columns 12 and 13 exhibit in roubles per inhabitant the quantity of production both of manufactured goods (Column 12) and of cereals (Column 13), these figures showing clearly the relative degree of development in the Region concerned of the two classes of industries, manufacturing and agricultural. For the further explanation of the character of the regions of Russia, the Tables on pages XXVIII and XXIX also is inserted, taken from the report recently published by the Department of Trade and Manufactures, under the title, «Statistical Results of the Rates and assessed Taxes for the Year 1889». In 1889 both guild and non-guild, commercial and industrial undertakings, were all subject to assessment. All the more extensive commercial undertakings pay guild dues, while some industrial enterprises are exempt. Among the various forms of business were included, 1,184 companies with shares, not counting railways and mutual insurance. 142,981 guild concerns, among which were purely commercial, contracts, hotels, warehouses and carriers, besides manufactures, printing offices, photographic shops, tailor and bookmaker shops and other trades and industries. There were further 250,624 non-guild forms of business, in all 394,789 concerns, or including those exempt from assessed taxes and rates, 420,000 undertakings.

It must here be observed that Finland knows no assessed taxes and that rates are collected throughout the Empire, again excepting Finland, from industries and all kinds of undertakings with shares. Assessed taxes are not exacted in the Central Asiatic district, while in the Transcaucasian governments, in Siberia and in the governments of Tobolsk, Tomsk, Yeniseisk and Irkutsk, they are collected only from undertakings, the remaining or non-guild being exempt therefrom. Finally, in the governments of Olonets and Archangel assessed taxes are only exacted from guild enterprises. Among the undertakings paying assessed taxes but not paying guild dues, namely such as are small and personal, are both commercial and industrial or manufacturing undertakings. For the purpose of this work, there is no need to distinguish payers of guild dues from others. It is more important to draw the dis-

tion among these two classes between the commercial and industrial undertakings which are registered during the collection of the assessed taxes and rates. This is done in Table 6 annexed, where the amount of the annual output and profits arising from them is given in millions of roubles. As in Finland and in the Central Asiatic Region the taxes under consideration are not collected, and there exists no corresponding information, these districts have been omitted from the table, which, judging from what has been said above, neither gives complete information upon the Northern nor the Siberia regions. For the remaining regions the data given must be regarded as the most complete of all as yet collected. At the same time it must be observed that the total amount of the assessed taxes received by the treasury from commercial and industrial undertakings in 1889, reached 5,078,068 roubles, upon a calculated total revenue from the undertakings taxed of 280 million roubles, this tax thus forming but 1.8 per cent of the revenue. There is, therefore, no reason to suppose that in the calculation of the operations and revenues of undertakings any great error has crept in, the more so as they were determined by the local offices for tax collection assisted by selected tax payers. The supposition is, however, more likely that the reality exceeds the estimate.

The relative significance of the statistics for various district must be assumed to be worthy of credence, and therefore should form a concrete measure of the trading and industrial development and importance of the separate districts of Russia. As far, however, as concerns the data upon the three per cent tax payable from the revenues of share undertakings, they are drawn straight from actual reports and are not subject to question on the score of their accuracy, although the extent of the annual operations is not given, but merely the amount of profits. But as on the calculation of the assessed rates from guild or large private non-share trading concerns (Table 6, columns 6 and 7) it is proved that they have an annual turnover of forty roubles for every rouble of profits; in the same way, in the case of commercial share undertakings it has been assumed that one rouble of profits corresponds to fifty roubles of annual turnover, as share operations do not yield as great profits as private concerns. In like manner, from the fact that in industrial guild undertakings there are about 15 roubles of turnover to one rouble of profits (Columns 9 and 10), one must conclude that in the case of industrial share undertakings about 20 roubles worth of business corresponds annually to each rouble of profits. (Column 4). From these hypotheses it is clear that an arbitrary element in the calculations creeps in, and therefore the data taken direct from the official report exhibited in the first sixteen columns should be sharply separated from the conditional deductions drawn by the writer of this Introduction and placed in the last columns. In this way the annexed table № 6, has the following contents: first, from the data upon the rates, that is, upon share undertakings; 1. the number of commercial undertakings; 2. their profits; 3. the number of industrial or manufacturing undertakings; 4. their profits; second, from data upon guild, non-share undertakings; 5. the number of commercial undertakings; 6. their annual turnover; 7. their annual profit; 8. the number of industrial undertakings; 9. their annual turnover; 10. their profit; third, from the data upon non-guild or smaller, but not the smallest, private undertakings not liable to assessment; 11. the number of commercial undertakings paying tax; 12. their turnover; 13. their profit; 14. the number of industrial

undertakings of the same category; 15. their turnover; 16. their profit; in the following columns are given the conclusions, namely: 17. the sum of the annual turnovers of the commercial undertakings, that is, the 2nd column multiplied by 20 + that of the 6th column + that of the 12th column; 18. the sum of the annual turnovers of the industrial undertakings, that is, the sum of the figures of the 4th column multiplied by 20 + that of the 9th column + that of the 15th column; 19. the sum of all the turnovers of the undertakings subject to rates and assessed taxes, that is,

TABLE 6.

UNDERTAKINGS ASSESSED WITH A SPECIAL ADDITIONAL TRADE PERCENTAGE AND DISTRIBUTARY TAX, 1889.	SHARE.				LARGE (GUILD, PRIVATE).					
	Commercial.		Industrial.		Commercial.			Industrial.		
	Number.	Profit.	Number.	Profit.	Number.	Turnover.	Profit.	Number.	Turnover.	Profit.
	Profits and turnover in									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
I. Moscow government	50	8.7	159	22.7	8978	1560	23	1996	138	8
> Central district	93	0.7	27	2.9	11889	167	11	1381	88	6
II. Petersburg government	96	18.0	87	12.3	8759	2081	26	1037	68	4
> Baltic region	82	1.7	17	1.3	7501	373	11	792	35	2
IV. Northern region	7	0.1	—	—	2477	31	2	157	6	0.
V. Eastern region	82	0.8	5	0.2	15421	222	15	977	20	1.
VI. Siberia (part only assessed).	25	0.1	—	—	4832	61	5	229	5	0.
VIII. Northern Caucasus	16	0.1	6	0.5	6617	96	7	176	3	0.
IX. Southern region	77	3.8	19	0.9	16439	1342	37	1104	46	5
X. South western region.	17	1.7	51	4.4	6791	101	6	824	18	2
XI. Polish region	24	1.9	58	6.5	6530	348	9	1410	88	5
XII. North-western region.	40	1.1	—	—	6098	94	5	613	13	1
XIII. Little Russian region	41	2.2	10	0.4	8314	156	10	692	20	2
XIV. Central Chernoziom region	90	0.8	4	0.2	18765	196	11	2182	53	4
	740	42	443	52	129411	6828	178	13570	601	4

the sum of the figures of the 17th and 18th columns. The data for the metropolitan governments, Moscow and Petersburg, are separated in this table in distinct lines.

The figures of the 18th column exceed those representing the production of the mills and manufactories, which is given for 1889 upon page VII, (with the excep-

tion of those subject to excise and those placed under the control of the Mining Department), principally because here are included such industrial establishments as workshops and rather small trades, tailoring, bookmaking, bakeries, bookbinding and sign-painting, workmen's cooperative societies (artels), flour mills and such like, which do not enter into the number of manufactories and works reckoned in the totals quoted in the 3rd, 4th and 5th tables.

TABLE 6.

SMALLER NON-GUILD PRIVATE.						MILLIONS OF PAPER ROUBLES.			Turnover in roubles per inhabitant.	No. of district or region.
Commercial.			Industrial.			Total commercial turnover.	Total industrial turnover.	Total commercial and industrial turnover.		
Number of undertakings.	Turnover.	Profit.	Number of undertakings.	Turnover.	Profit.					
Millions of paper roubles.						50 (2) + (6) + (12)	20 (4) + (9) + (15)	(17) + (18)		
11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	
8,560	42	4.7	3,700	24	2.6	{ 2,281	770	3,051	254	I
20,949	42	3.5	2,190	8	0.6					
8,225	56	4.0	2,514	16	1.5	{ 3,521	397	3,918	653	II
12,704	26	3.2	1,298	6	0.9					
2,628	3	0.2	55	0.1	0.0	39	6	45	23	IV
25,897	51	4.2	1,537	6	0.5	313	30	343	23	V
—	—	—	—	—	—	66	5	71	—	VI
4,345	8	1.2	250	1	0.2	109	14	123	—	VIII
22,511	67	8.6	1,458	9	1.3	1,599	73	1,672	167	IX
24,067	46	5.3	1,260	4	0.5	232	110	342	43	X
31,537	69	6.9	2,035	8	0.9	512	226	738	82	XI
20,800	36	3.9	835	3	0.3	185	16	201	22	XII
13,191	20	2.0	715	3	0.3	286	31	317	42	XIII
35,126	50	4.0	2,237	6	0.5	286	63	349	18	XIV
230,540	516	52	20,034	94	10	9,455	1,741	11,196		

In reference to the Northern Region (IV) it must be observed that the Olo- nets and Archangel governments do not pay distributary taxes upon non-guild undertakings. In Siberia such dues are introduced only in parts of the country, and there only upon guild operations. Transcaucasia and Central Asia also do not bear distrib-

untary taxes while in Finland there exists the income tax of a totally different character. For this reason the total amount of the operations for the whole Empire is higher than that given in the 19th column of the table. For the comparison, however, of the commercial and industrial activity of the majority of regions in Russia the data set forth are sufficiently reliable.

A few mining share industries and some excise industries enter into the number of industrial undertakings paying percentage taxes (Column 2) while among industrial undertakings paying distributary taxes are included printing offices, photographic studios, bakeries and other similar forms of business, not registered in Russia among manufacturing industries. In consequence thereof this figure is higher than that cited above. Another cause of the discrepancy in the figures is due to the fact that the turnover of the share undertakings (Column 4) was found from the profits by multiplying by twenty, a process which has only a conditional force for the comparison of the turnovers for different regions of Russia.

The considerable magnitude of the total business, per inhabitant in the Baltopetersburg region is evidenced not only by the fact that certain branches of administrative, industrial and commercial activity are concentrated in St. Petersburg, but also by the fact that here are centered many commercial and industrial enterprises, such as banks and insurance companies, which operate over the whole of Russia. From the figures quoted above it appears that commercial and industrial operations taken together are most active in the Moscow, Petersburg, Polish, Southern and Eastern regions of Russia. If the commercial operations of the Petersburg Region prove the greatest, it depends upon the concentration there of the chief capital of extensive monetary operations of many banks, insurance companies, stock companies in general and sea trade.

The considerable amount of the commercial operations of the Moscow Region depends not only upon concentration for many years of large commercial concerns furnishing the majority of the provinces with all kinds of merchandise, such as manufactures, tea, sugar and other necessities, but upon the fact that manufacturing industry is here more highly developed than in any of the other regions. Next follows, in respect to the sum total of their commercial operations, the Southern Region, the cause of which must be sought for in the neighbourhood of the Black Sea, whose ports carry on an immense home and foreign trade, manufacturing began here only thirty years ago, but promises a rapid growth, thanks to the scarcely touched wealth of the Donets basin whose coal has already begun to attract to itself the iron and chemical industries. In the Polish Region, although the works and manufactories are, on account of the density of the population, much more considerably developed than in the Southern Region, nevertheless commercial operations are only one-third of those in south Russia. This difference in the two regions in question (IX and XI) is the more remarkable that their populations are almost equal, although the area of the Polish Region is scarcely one-fifth of that of the Southern. The chief cause of the difference must be sought in the fact that the Black Sea and the Sea of Azov give life to the whole foreign trade of Russia, especially in reference to the export of grain.

The following statistics show the importance of the Black Sea ports and of grain freightage in the Russian export trade:

TABLE 7.

	ALL GOODS OVER ALL FRONTIERS.			EXPORT BY SEA OF GOODS.		
	Import of foreign goods.	Export.	Total.	By seas of Southern Region.	Caucasian ports.	Baltic ports.
	In millions of roubles.					
1883	562	640	1,202	184	8	247
1884	538	589	1,127	177	15	217
1885	434	539	973	195	14	159
1886	438	488	926	172	23	144
1887	393	623	1,016	281	24	175
1888	391	794	1,185	342	31	200
1889	437	766	1,203	304	48	194
1890	416	704	1,120	260	60	179 *

TABLE 8.

	Export of all goods.		I.	II.		III.
	Across all frontiers.	Across European frontier.	Export of all except breadstuffs across European frontier.	Export of breadstuffs across European frontier.		Average price for five years per pound of breadstuffs exported.
	Millions of roubles.			Millions Pouds. Ronbles.		
1876	401	379	176	221	203	102.5 kop.
1877	528	508	244	260	264	
1878	618	597	231	371	366	
1879	628	606	243	348	363	
1880	499	476	243	198	228	
1881	506	481	240	202	241	102 kop.
1882	618	590	269	293	321	
1883	640	608	258	336	350	
1884	590	551	241	308	310	
1885	539	498	218	331	280	
1886	488	437	220	261	217	81.5 kop.
1887	623	569	261	377	308	
1888	794	728	301	522	427	
1889	766	687	335	438	352	
1890	704	610	301	380	309	

* About 70 per cent by value of all the foreign trade of Russia is by sea. Such is the importance of the seacoast for the country.

I. In Table 10, are shown what kinds of goods other than grain are exported by Russia and in what quantities.

II. Wheat, rye, barley, oats, buckwheat, millet, maize, peas, beans, meal, spelt, flower and bran.

III. The figures of this column show that from the year 1885 the prices of breadstuffs, under the influence of the duties in many countries of Europe and under the influence of other causes, began to fall perceptibly. A part of the change in the average price of exported breadstuffs depends upon the fact that in the course of time the demand for cheaper rye began to increase, in place of the former export, almost exclusively restricted to wheat.

The great commercial importance of the Moscow, Petersburg, and Southern regions comes prominently into view even on considering the number of trade documents, certificates, tickets and licenses to trade, issued in the various districts, as seen in Table 9, especially from the total of certificates of the first and second guilds, as they are chosen by peoples carrying on large business. These figures increase visibly, as years go on, as seen from a comparison of the data for 1880 and 1890, while a less number of persons are occupied with huckstering or retail trade in small shops to-day than ten years ago.

Next, putting aside peculiarities belonging to parts of the Empire the fundamental data concerning the sum total of the commercial and manufacturing relations of the whole of Russia, namely, her foreign and home trade and manufacturing industry as far as they are recorded and expressed in large figures, giving an objective idea of the existing industrial and economical conditions of Russia, should be considered.

NUMBER OF TRADE CERTIFICATES AND LICENSES ISSUED IN 1880.

TABLE 9.

1880. REGIONS.	First guild.		Second guild.		Retail trade.		Industrial certificates.	Clerk certificates.	Sum of 2, 4, 6 and 7.	Sum of 2 and 4.
	Certificates.	Licenses.	Certificates.	Licenses.	Certificates.	Licenses.				
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Moscow-Central . .	794	2,666	12,466	20,303	43,303	50,527	3,013	32,102	77	26
Baltic-Petersburg .	714	1,737	7,255	11,753	31,819	20,728	5,205	25,658	38	13
Northern	35	225	1,352	2,485	4,487	6,142	319	3,767	9	3
Eastern	229	1,284	7,214	14,052	22,132	36,866	2,301	25,577	54	15
Siberia	169	566	3,208	4,650	7,324	7,804	1,003	9,965	14	5
Central Asiatic . .	46	298	1,660	3,374	5,946	13,164	1,937	5,858	19	4
Caucasus	47	263	3,280	6,286	4,624	4,255	621	4,330	11	7
Southern	339	1,230	8,128	13,057	29,583	29,227	6,208	27,784	50	14
South-western . . .	251	865	3,450	6,099	19,215	26,251	8,296	20,743	42	7
Vistula	199	286	4,219	4,507	30,488	38,993	17,439	13,167	61	5
North-western . . .	134	327	2,919	4,719	15,799	23,851	12,380	12,352	41	5
Little Russian . . .	91	493	4,501	7,775	18,278	21,984	2,984	14,694	33	8
Central Chernoziom.	298	968	11,011	18,165	35,919	47,042	4,101	29,807	70	19
Total (without Finland) in thousands.	3.3	11.2	70.7	117.2	269.0	326.8	65.8	224.8	520	128

The importance of Russia's foreign trade, which is very considerable, as far as concerns the import of tea, cotton and machinery and the export of raw materials, especially breadstuffs, timber, flax and in general all kinds of productions of agricultural industry, falls into the background in respect to both importation and exportation, in comparison to the majority of goods produced by manufactories and mills, and this principally for the reasons that the consumption of these goods develops in Russia rather slowly and only in reference to goods of home origin, while their production in the majority of cases does not yet reach an amount sufficient to satisfy the growing home demands and furnish a surplus to foreign consumers. That the consumption of the above mentioned goods develops slowly is best proved by the fact that cotton fabrics, sugar, petroleum products and coal began to increase from the period when these goods began to be obtained within the country. Among those branches of manufacturing industry which have been developed in Russia sufficiently long under the influence of an existing home demand and protective duties, very many productions of manufactories and mills, after satisfying the home requirements, have already begun to find an issue abroad, a fact which serves to demonstrate that there already exist in Russia, albeit little developed, the conditions for a successful and most profitable business for a number of manufacturing industries. In proof, are quoted the

NUMBER OF TRADE CERTIFICATES AND LICENSES ISSUED IN 1890.

TABLE 9.

1890. REGIONS.	First guild.		Second guild.		Retail trade.		Industrial certificates.	Clerk certificates.	Sum of 2, 4, 6, and 7.	Sum of 2 and 4.
	Certificates.	Licenses.	Certificates.	Licenses.	Certificates.	Licenses.				
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Moscow-Central . .	1,198	3,524	17,422	25,306	38,138	23,394	17,228	39,083	70	29
Baltic-Petersburg .	1,150	2,454	13,504	19,557	28,026	7,040	14,729	36,803	44	22
Northern	34	197	1,648	2,633	6,110	3,338	1,015	3,798	7	3
Eastern	273	1,229	10,556	16,442	31,749	21,799	4,424	26,773	44	18
Siberia	141	590	5,619	7,498	10,101	4,463	1,906	11,608	14	8
Central Asiatic . .	48	435	1,631	2,397	11,189	23,546	2,082	2,937	28	3
Caucasus	151	858	10,915	16,305	20,791	9,187	4,153	13,319	30	17
Southern	512	2,004	14,320	21,107	34,797	18,790	6,523	30,059	48	23
South-western . . .	383	1,302	6,123	9,366	29,403	22,598	4,329	17,532	38	11
Vistula	389	890	6,809	8,002	40,170	28,106	7,778	13,534	45	9
North-western . . .	211	580	5,251	7,463	25,743	18,352	3,987	8,969	30	8
Little Russian . . .	132	525	6,485	9,640	18,181	13,797	2,875	12,044	27	10
Central Chernoziom.	261	1,025	13,496	19,490	43,252	24,582	6,456	29,211	52	21
Total (without Finland) in thousands . .	4.9	15.6	113.8	165.2	337.6	219.0	77.5	245.7	477	182

data on exportation. during several years, of spirit, sugar and petroleum products. In the last column is cited by way of example the export of the production of the peasantry which has found a regularly increasing sale upon the markets of Western Europe, namely hen eggs. These illustrations show, that apart from breadstuffs Russia's export is capable of rapid growth and is assuming large economical proportions.

EXPORT ACROSS ALL FRONTIERS.	Thousands of vedros, abso- lute alcohol.	Sugar and raw sugar in thous. ponds.	Petroleum products, mil- lion ponds.	Hen eggs, millions.	Total value, million roun- bles
1873.	1,000	1	—	30	3
1884.	2,340	118	6.9	239	20
1887.	6,506	4,582	19.0	507	50
1888.	5,335	5,581	34.9	685	68
1889.	4,021	4,971	44.8	609	70
1890.	4 257	3,313	48.1	751	60
1891.	4,026	7,578	54.2	834	80

The foreign export of Russian products of the manufacturing industry, as of agricultural, only in a still higher degree, depends upon the cheapness of the means of delivering these products at the frontiers of the Empire; and in this respect, in the last 20 years with the construction of railways, many goods have found an outlet, as shown in the Review published by the Ministry of Ways of Communication. This side of the business has only lately begun to develop, and that slowly. Furthermore, the Government protective tariff was brought to a completion only in the middle of 1891, when it already began to excite an increase in the manufacturing activity of Russia. Moreover, many deposits of natural wealth have now first become known and worked, such as the coal measures of the Donets, Transcaspian sulphur, Caucasian formations of natural Glauber's salt (the source of the cheapest production of soda and glass), the pyrites of the Ural, ores of nickel, mercury and manganese. Add to all this the fact that the price of labour in Russia is cheaper than in the majority of countries of the West, and it will appear that the manufacturing activity of Russia has before it an indisputable quickening and growth which will give the world's trade a mass of goods in whose increased production the national labour and capital will find a new source for heightening the prosperity of the country, not yielding to that furnished by its agricultural activity.

The low price of labour in Russia, referred to above, is an economical factor of so much importance as to deserve something more than a bare mention. The chief causes of the comparative cheapness of time and piece wages paid to workmen in the production of many manufactured articles in Russia are: 1. the great supply, the number of persons who must seek earnings outside of agriculture, that occupation being already very great as appears from the following calculation taken by way of example. For all the different kinds of labour expended in the production per pound of grain together with the collateral cultivations, as well as the associated labour in-

volved, the harvest being small, not more than three working days need be reckoned, while in the case of satisfactory harvests these will be not more than one day, and therefore assuming two days as the mean (The Rational Tariff, Mendeleyev, 1892, page 145) and allowing the total cereal harvest of Russia to be equal to 2,500,000,000 pouds, which is certainly higher than the fact, the result would be that for purely agricultural activity Russia requires not more than 5,000 million working days. If however, it be reckoned that out of 120 million Russian inhabitants only 50 millions are occupied with work, and that the working time is limited to only 200 days in the year, it will result that there are 10,000 million working days, that is, at least twice as many as are required for agriculture, which again is in harmony with the fact that in the winter time agricultural occupations almost entirely cease; 2. The Russian workman, being to a certain extent secured by an allotment of land and by the comparative cheapness of bread and the other fundamental conditions of life, looks upon all earnings outside of agriculture, and especially upon winter and manufactory earnings as so much pure profit. If then, there is even the slightest competition in the offering of services he takes such work for an inconsiderable remuneration, the more so that otherwise he is confronted with the necessity of remaining idle, as in the manufactories and mills there are now only 1,500,000 persons employed; 3. The solicitude of the government about the condition of the workmen in the manufactories and works furnishes the workmen with the assurance that they are there much better secured than if they remained at their agricultural employments, as the inspectors of mines and factories take care that the masters in no way oppress the workmen and that they should get the necessary accomodation and hospital service, which does not obtain in the case of ordinary village life, or in that of hired agricultural labour.

Seeing that the indicated circumstances cannot by themselves be presented in their entirety in the shape of proofs, which shall be at the same time evident, comparative and numerical, it seems necessary to confirm the preceding fundamental position of the relative cheapness of labor in Russia by referring to a concrete case with the figures. The coal industry is taken as an illustration, because here the cost of the product clearly depends chiefly upon the wages, while the number of workmen is well known.

According to official data, for example in 1890, 367,000,000 pouds of coal were produced in Russia, the number of workmen employed being 40,571 and the selling price at the mines, from 2 to 8 kopecks a poud, or an average, never more than 6 kopecks. These figures show, assuming only 200 working days in the year (in the summer a part of the workmen leaving the mines), that there falls to the share of each workman, inclusive of all preliminary and general expenses in respect to mines, machines, sharings, management and owner's profit, 9,045 pouds, or 148 tons of coal a year; that is, about 542 roubles, or about 270 dollars per annum, or 45 pouds, and 2.70 roubles a day. The workman actually receives from 1 to 1.45 roubles, as I know from personal investigation of the Donets industry. In Great Britain, for example, in 1884 (Munro, British Association, 1885), 160,700,000 tons or 9,960,000,000 pouds are mined per year; the number of workmen employed is 520,000 and the average price per ton at the mines is not less than 9 shillings or about 7.25 kopecks per poud. Accordingly to each workman falls about 309 tons of coal, or about 1,390 roubles a year. Assuming 300 working days to the year, which

is about right for Great Britain, the result will be about 1 ton or 4.5 roubles per workman a day, that is, in Great Britain the workman gets in annual wages two and one-half times, and in day wages, about twice as much as the Russian miner; and this is so, although the prices of machinery and capital expended are indisputably higher than in England. The cause of so great a difference lies only in this, that the payment of workmen by the day or piece in Russia is about half of that paid in England.

A number of most profitable and important industrial undertakings may be founded upon the cheap labour of Russia and may freely compete with the corresponding industries of the west upon the condition, of course, of their attaining complete development and sufficient industrial and commercial credit. The attainment of this result is the more likely, the greater the degree in which wages enter into the price of the product. Competition and economic and social progress tend to reduce the price of all goods to such an extent that it may approach the sum paid to the workmen. As capital cheapens and may be directly or indirectly lowered in its value by state enterprises, it follows then that the industrial future on its external aspect, that is, apart from the development of the spirit of industrial enterprise, belongs beyond doubt to the countries possessing the conditions of cheap provisions and, therefore, comparatively cheap wages. Russia is assured these conditions not only for the present but for the far distant future. If this shall once be understood in all its integrity by the Russian people in the same measure as it is by the Government, the industrial success of Russia must follow rapidly, and there are many grounds for thinking that the present represents the stage of transition to this future epoch of the life of the Empire.

It must now be seen, and the same conclusion is to be deduced from the more minute estimate of the situation of some branches of Russian industry presented in this book, that the manufacturing activity of Russia cannot be regarded otherwise than as an earnest of the future. The history of the origin of the majority of the industries is still very recent, and the requirements of the people who still preserve the patriarchal character of their lives, are till now very simple. The preceding considerations also explain the commercial peculiarities of Russia in the foreign trade, the sale of raw materials and the demand for the machinery of new industries and for half-manufactured goods, which have not yet become firmly established in the country, in the home trade, the transport of grain and raw materials to the centres of industrial activity on the one hand, and the export from those centres of a few products of manufacturing activity not presenting any great variety, on the other. In this sense Moscow, St. Petersburg, Warsaw and Odessa are related to the majority of the other districts of Russia, as centres yielding the trade results of manufacturing industry, while receiving from them grain, fuel and every kind of raw material.

For the more accurate characterization of the foreign trade relations of Russia a quotation is made in the form of a short summary (Table 10), of the average annual result, in reference to the quantity by weight and the value of the principal groups of goods, distributing the raw and half-manufactured wares, alike imported and exported by Russia, according to their origin from the three natural kingdoms, and taking for this purpose the data for the five years from 1884 to 1888.

TABLE 10.

E X P O R T S.			I M P O R T S.		
PRINCIPAL ARTICLES OF EXPORTATION.	Millions of pouds.	Millions of roubles.	PRINCIPAL ARTICLES OF IMPORTATION.	Millions of pouds.	Millions of roubles.
MINERALS.			MINERALS.		
1. Stones, principally phosphorites	3.3	0.5	Marble, chalk, millstones . .	8.6	2.3
2. Earths, clay to frontier places	0.1	0.0	White and coloured clay . .	2.3	0.5
3. Ores: manganese, iron, etc.	3.0	1.4	To frontier districts.	0.4	0.3
4. Salts, table salt	0.5	0.1	Chili saltpetre and table salt.	2.3	2.0
5. Combustibles: raw petroleum, coal to Roumania.	1.4	0.8	Sulphur and coal, especially to Baltic ports	107	14.5
		3			20
VEGETABLE GOODS.			VEGETABLE GOODS.		
6. Food: wheat, rye, oats and other grains	400	330	Tea, coffee, fruits, spices, tobacco	11	88
7. Parts of plants: flax, hemp, wood	162	145	Cotton, indigo, olive oil . . .	27	115
		475			203
GOODS FROM THE ANIMAL KINGDOM.			GOODS FROM THE ANIMAL KINGDOM.		
8. Animals and meat: domestic animals, eggs . .	8	25	Chiefly herrings.	5	8
9. Furs and wool	4	36		0.7	12
10. Animal products: tallow, bones, butter.	3	10	Chiefly silk.	1.9	4
		71			24
PRODUCTS OF WORKS.			PRODUCTS OF WORKS.		
11. Metals, sheet iron, etc. .	0.4	2	Iron, cast iron, lead	19	27
12. Cement, glass and pottery.	2.1	1	Chiefly cement and glass . .	5	5
13. Chemical and dyes . . .	0.2	1	Chiefly soda and colours. . .	4	18
14. Carbonaceous products, kerosene, leather, tar. .	29.4	19	Leather and coal, tar. . . .	1	10
15. Liquors and prepared provisions (spirit and sugar).	8.1	24	Wine and cheese	1	10
		47			70
MANUFACTURED GOODS.			MANUFACTURED GOODS.		
16. Machines and metal goods, silver and steel	0.1	1.9	Various machines and instruments	3.9	33
17. Yarn and tissues	1.1	9.8	Fine yarn, costly tissues . .	1.1	46
18. House furniture, clothes, travelling appliances . .	0.1	4.4	Iron ships, haberdashery. . .	1.0	10
19. Paper, books, and other appliances of the arts and sciences	0.1	1.0	Books, paper	1.4	12
		17			101
Total	627	613	Total	204	418

The average value of a pound of goods exported from Russia is less than a rouble, because the export of grain predominates, whose value closely approaches that sum. The goods imported into Russia, on the other hand, present a value per pound of more than two roubles, although coal exceeds half the imports by weight. Deducting this, there remain imports, about 96,000,000 pounds, to the amount of about 403,000,000 paper roubles. The average value, therefore, of a pound of imported goods exceeds 4 roubles which depends upon the predominance among the imports of such dear goods as tea, fruits, cotton, machines and yarn. The preponderance in weight of Russian exports over imports leads to the consequence that sea-going ships must often come into Russian ports in ballast.

Among the exports preponderate vegetable and animal raw materials, and to a certain extent the products of distilleries and refineries, such as spirit, sugar, and kerosene; in the imports, the two extremes of mineral raw material and manufactured goods. The former have been long in the enjoyment of a powerful customs protection, while upon their production within the country were levied considerable excise dues. The state of the imports proves that for the development of the economical life of Russia the most pressing needs at the present time are increased mining industries, works, manufactories and trades. It is of course not possible to have such complete information upon the home trade as upon the foreign. Judgments upon the former can only be formed upon the basis of two kinds of statistical information. the number of trade documents and the business done by commercial undertakings subject to income tax and assessment dues. Table 9, based upon data of the first kind, tables 6 and 11, upon data of the second kind, make it possible to form an opinion of the extent and distribution of the various forms of local industry. Further particulars referring to the home trade of Russia are set forth in the article upon the markets of Russia, inserted in this volume, and in a special publication of the Ministry of Ways of Communication, composed for the World's Columbian Exposition, in which are considered both the ways of communication themselves and the traffic over them.

It is most important to direct attention to the fact that with the development of the protective system the foreign trade of Russia, speaking in general terms, has not changed, has rather increased than diminished, while the home trade has unmistakably increased. In 1871 the foreign trade consisted of 369,000,000 roubles export, and of 380,000,000 roubles import, that is, the whole trade formed 749,000,000 roubles. In 1880 it was equal to 499,000,000 export and 604,000,000 import, total 1,103,000,000 roubles, at a time when the protective system had only begun to act, and that feebly. In 1890 it was equal to 704,000,000 exports and 416,000,000 imports, or total 1,120,000,000. In 1891, when in consequence of the lack of grain its export was forbidden for part of the year, thus diminishing the export trade, the latter was 722,000,000 roubles, the import 379,000,000 roubles, that is, in all 1,101,000,000 roubles or equal to the trade of 1880, with the sole difference that in 1880 the imports exceeded the exports, while in 1891, as latterly in general, the exports on the contrary have exceeded the imports. This preponderance of exports over imports may be judged by the data inserted in Table 7.

An idea of the increase during the last few years of the total trade, both home and foreign, may be gathered from the fact that the number of trade licenses,

guild and non-guild certificates and tickets, taken out (Table 9), and the tax received from them, have been growing manifestly, even within the comparatively short period of five years.

Licenses to trade.		Tax upon licenses.
1885	1,094,238	21,770,174 roubles.
1886	1,171,578	22,746,431 »
1887	1,171,186	23,623,007 »
1888	1,194,812	24,818,608 »
1889	1,235,858	25,053,146 »

Comparing the above stated number, 1,236,000 of trade certificates for 1889 (exclusive of 253,000 clerk certificates 983,000 will remain) with the number of commercial undertakings paying the assessed tax, their number being, as shown in Table 6, about 360,000, it will appear that the majority of such undertakings belong to the category of the small trades, a result which also follows from the fact that in 1889 there were issued for the whole Empire 23,000 first guild, 311,000 second guild certificates with the right of trading on a medium footing, and 648,000 certificates for petty trade and huckstering. Among the representatives of the last class of trade there are some 25,000 traders employed exclusively in the sale of articles as peddlars. This is due to the circumstance that many peasant wares circulate in Russia in the villages, through the medium of special hucksters, peddlars and costermongers, who often extend their visits to very remote regions of the country. Some of these traders barter their wares for flax, eggs, down, bristles and other products of peasant economy; in this way sometimes large quantities of goods are collected. Speaking generally, however, in Russia not more than one per cent of the inhabitants are employed in trade, or if the unskilled workmen occupied as accessories to trade and the families of traders be included, it may be estimated that about 3 to 4 per cent of the population in Russia are engaged in trade. This is about the proportion of persons deriving a livelihood from various kinds of mining and manufacturing activity (Table 12); and if a like number be reckoned as living upon trades and military and civil service the long recognised fact results, that the great bulk of the population of Russia, about 85 per cent, live upon the land. It cannot, however, be denied that this state of things in the present period of protection of the development of industry is changing somewhat.

The percentage of the inhabitants engaged in industry and trade is gradually increasing, a state of things which is justified not only by the facts communicated upon the first pages of this Introduction, especially by the cheapening of grain, but also by other considerations. For the tilling of the land and the care of agricultural operations in forms at all intensive in character, that is, with the employment of improved machinery, an incomparably less percentage of the population is required than that which is now engaged in farming in Russia. With the present course of things, the present prices of agricultural labour are much lower than those of all other kinds of occupations, a fact which is demonstrated by direct calculation in the writer's work, «A Rational Tariff», 1892, page 145, and in this Introduction. It may then be affirmed that it is only just to expect in the future a rise in the prices of agricultural products and a relative fall in those of all kinds of manufactured articles.

In Russia, again more often than in any other country, agricultural activity is able to be combined with the industrial and the commercial, which is based upon the fact that the peasants all have their lots of land and are able to devote a small portion of their time, especially the so-called *strada* or season of mowing hay and reaping grain when farming demands many hands, to agriculture; the greater part, and in particular the whole of the winter, they can give to manufactories and mills, or to the small household or domestic industries called *kustarny*. This very desirable combination of agricultural with industrial activity is realised in that form, called *kustarny* which is specially considered in Volume I of this work, prepared for the World's Columbian Exposition. There is no doubt but that these occupations form a large branch of the manufacturing industries of Russia, but it is impossible to have sufficiently exact information upon them as they are entirely free, not subject to any Government taxes and so escape registration. Some idea, however, of their extent may be at times obtained, an example of which is the leather industry, set forth in Chapter VI. Here according to the data extant collected by Professor Vylezhinsky it is reckoned that the production of the registered works being equal to 42,000,000 roubles a year, that of the *kustars* is about 58,000,000. It is further known that the household industry in the working up of various materials into hardware, especially knives, locks, door appliances, nails et cetera, into woodworks, especially in the making of casks, wheels, carts, yokes, boxes and shovels, in the manufacture of articles from horn, as combs and buttons, in the preparation of pasteboard and many other manufactures, occupies a number of hands, and has every chance of competing with large manufacturing enterprises, especially with the help which is extended the *kustars* from the Government and Zemstvos.

By way of an example in support of the above view, may be cited the case of the cardboard industry in the Moscow government, which supplies apothecary shops and kindred houses. This trade is gradually passing from the manufactories into the hands of the *kustars*, thanks to the fact that the Zemstvos have taken the household industry of the Government under their special protection and have begun to supply the *kustars* themselves with the raw material used in their work. The conflict between the capitalist and the smaller enterprises may with such assistance take a different turn than ordinarily. It is known that the small undertakings of an industrial nature often perish when confronted with the competition of the great concerns. The cause of such ruin of the petty industries, general in all countries, must first of all be sought from an economical point of view in the importance of the capital lying at the disposition of the large undertakings, and from a technical point of view, in the adoption of large machines and appliances, for instance, blast furnaces, large motors and continuously acting furnaces. But the economical importance of capital can be weakened by the principle of the *artel*, or cooperation, the assistance of organs of local government, such as the Zemstvos, the influence of State enactments and the fall in the value of capital, expressed in a diminished rate of interest. All these factors are to-day, to a more or less extent, for one reason or another, taking place before our very eyes and constitute one of the forms of economical progress in which Russia is taking a manifest part. The technical influence of large machines and appliances, on the other hand, may be diminished in proportion as methods for the profitable subdivision of mechanical forces into small parts are

discovered, for example, by means of the extension of electric motors acting from central electrical stations. Further, comes the discovery of convenient methods of obtaining high temperatures and constant heat on a small scale. Towards both of these objects technical science is without doubt now striving, thus making manifest contributions on its part to the perfection of industrial and economical life. For these reasons it is impossible to consider that the last word has been pronounced in the struggle between large and small enterprises, and there is every hope that it will in time again appear most profitable and expedient to carry on part of the industries on a small scale, leaving only a portion of them to be handled as large enterprises, some of which will probably pass into the hands of the Government, as in the case of the railways.

It must be borne in mind that the *kustars* must receive raw material not only from agricultural industry, as for example, leather, horn, timber, but also from manufacturing industry, namely, metals and chemical products. It hence follows necessarily that the possibility of a wide development of household industry is possible only upon the condition of a simultaneous development of mining and manufacturing. The relative cost of machine work in the mills and factories, and upon hand work with the aid of a few tools only in household industry, indicates the limit to the extension of each of these forms of industry. At any rate, in the estimation of Russian industrial production according to the existing statistics, it is necessary always to bear in mind that the whole of household industry disappears in the existing accounts, and that it is in Russia very great.

There is yet one other vast form of industrial activity of Russia, which either entirely escapes registration or enters only partially, for example, into the accounts of the mining works. These are the government manufactories and mills, and such large undertakings as the railway companies. The needs of the Government, and in particular of the Departments of War and Marine, cause, on account of the limited character of private manufacturing enterprise, the frequent foundation of Government manufactories and mills. Such, for example, are the Department for the Preparation of Government Notes, which presents the most perfect institution in Russia for the manufacture of paper for engraving and printing, the mint, the laboratories for separating the noble metals, foundries, ordnance works, powder mills, factories for small arms, cartridge manufactories, tinued-provision manufactures, brass tube works, ship-building yards, works for making instruments used in measurement, and many others. The Government manufactories, in not a few cases, must be regarded as the founders of many kinds of industry in Russia. Such, for example, are the first cloth and paper manufactories, foundries, and porcelain works. They continue, however, in the majority of cases to exist only so long as private enterprise has not grown to a sufficient extent to satisfy the demand existing on the part of the Government. Many of the Government works thus represent only the first forms of the development of manufacturing industry in Russia. But as many forms of it, to judge from all that has been said above, are even now only in the primitive stages of their development, so there still exist not a few Government works, and manufactories of various kinds, which often escape registration. It is useful to keep this in view when considering the statistical data of the manufactories and mills.

In the annexed Table 11 is contained full information upon trade and industry, except mining and industries paying excise in Russia, without Finland, and with the omissions mentioned in connection with Table 6, according to the returns of the assessed and income taxes, which served in the construction of Table 6.

TABLE II.

ACCORDING TO THE DATA OF THE INCOME AND ASSESSED TAXES FOR 1889, FOR ALL RUSSIA.	SHARE UN- DER TAKINGS		GUILD UN- DER TAKINGS.		SMALL UN- DER TAKINGS.		TOTAL.
	Profit	Busi- ness	Profit.	Busi- ness.	Profit.	Busi- ness.	
Millions of paper roubles.							
Commercial undertakings:							
1. Banks ²	30.7	1,535	29.7	4,026	—	—	5,561
2. Insurance companies ³	3.9	195	—	—	—	—	195
3. Transportation ⁴	4.0	200	2.6	34	0.3	3	237
4. Water works, gas, electric lighting.	1.6	80	—	—	—	—	80
5. Trade in grain and other provi- sions	—	—	39.8	1,004	19.0	230	1,234
6. Trade in timber, furniture, flax and hemp	—	—	10.0	193	1.8	19	212
7. Trade in tissues, clothes, leather, writing paper	—	—	43.6	825	4.5	45	870
8. Trade in metals and metal goods	—	—	10.3	178	0.9	9	187
9. " " glass, chemical and other products.	—	—	8.4	133	1.0	1	144
10. Hotels, stores, baths, tobacco trade.	0.1	5	25.5	345	22.5	182	532
11. Contracts, offices, artels ⁵	0.1	5	0.4	52	0.1	1	58
12. Various trade concerns	1.8	90	2.7	39	1.6	16	145
							9,455
Industrial undertakings.							
1. Cotton goods.	21.4	328	4.1	58	0.1	2	488
2. Linen, hemp, bark goods	2.9	58	1.9	28	0.1	2	88
3. Woollen goods.	2.0	40	3.3	68	0.1	1	109
4. Silk " "	0.1	3	1.4	17	0.1	1	21
5. Dyeing, dressing and printing tis- sues	1.5	30	2.4	37	0.1	1	68
6. Writing and other paper, book- binding	0.5	11	0.9	15	0.2	2	28
7. Leather, gutta-percha, shoes	2.4	47	2.1	33	0.5	5	85
8. Woodwork, tannery, carpentry. . . .	0.5	9	2.6	35	0.7	6	50
9. Metal works, machines, carriages	2.2	44	3.5	55	1.3	11	110
10. Glass, porcelain, cement	0.8	16	2.4	35	0.3	3	54
11. Chemical goods, cosmetics.	1.2	24	1.0	18	0.1	1	43
12. Tallow, fats, oils, wax, stearin . .	0.8	16	1.0	17	0.8	8	41
13. Food	1.8	36	8.2	126	2.2	20	182
14. Mining ⁶	3.8	76	—	—	—	—	76
15. Spirit, sugar tobacco ⁶	8.6	172	—	—	—	—	172
16. Various industrial undertakings, as tailoring, printing and photog- raphy.	1.7	34	5.8	60	3.5	31	125
							1,740

¹ In the case of share undertakings only the profits are given. From them have been calculated the *conventional* amount of business, by multiplying the profit by 50 or trading, and by 20 for industrial undertakings.

² Except Government institutions.

³ Mutual insurance is not included, because it does not bear income tax.

⁴ Namely: tramways, steamers, various carrying enterprises; railways are not subject to tax.

⁵ Contracts play the chief part in the figures of this column.

⁶ Mining and excise-paying undertakings were not subject in 1889 to assessed tax, but only to income tax, which is paid by share undertakings; they are therefore placed in the Table only in the column of such enterprises.

It appears from the data of Table 11 that the operations of trade exceed those of the manufactories and mills, subject to income and assessed taxes, five and one-half times. Such a remarkable predominance of trade activity over industry depends not only upon the fact that in the first participate the products of agriculture, especially grain, the operations in which are very considerable both at home (Table 5) and abroad (Table 8: but upon the fact that trade in Russia has several stages of transmission, or intermediate steps, in passing from the producers to the consumers. This latter circumstance is determined both by the vastness of the distances dividing them from each other, and by the minute character of the trading institutions, all of which without exception are subject to record, although not all pay income or assessed taxes.

To judge of the distribution of the total production (Table 3) among the various forms of manufactories and mills, the data on the production of those not subject to excise, for the whole Empire except Finland, will be first given.

MANUFACTURES.	1880.	1890.
	PAPER ROUBLES.	
Textile manufactures.	419,500,000	518,700,000
Writing paper.	16,000,000	22,300,000
Wood work.	19,000,000	33,400,000
Metal »	115,600,000	148,800,000
Ceramic industry, glass, cement. . . .	27,300,000	32,500,000
Chemicals, colours.	13,400,000	23,900,000
Leather and other animal products . .	97,600,000	74,300,000
Comestibles	123,900,000	190,600,000
Various industries not included above .	9,400,000	18,600,000
	848,000,000	1,064,000,000

These data of the Department of Trade and Manufactures do not include either the production of articles paying excise or mining works. Making use of the information upon this subject, and of that upon the income and assessed taxes (Tables 6 and 11), and adding the information concerning Finland, there results the following picture of the development of the whole of the larger industrial and manufacturing enterprises of Russia. The data are here distributed according to the kinds of goods produced, and in the order in which they are considered in the several Chapters of this Volume, with the addition of the facts about the mining industry. The following Table is based upon official sources, and answers approximately to the contemporary state of things; but it is impossible that it should be quite complete for a number of reasons, already explained above. The chief of these is that the minor

industries, and some of the Government works, do not appear in the present system of registration. Further, in many industries the prime material is derived from the products of other correlative manufactories and works; for example, cast iron and iron in the manufacture of machinery, hardware and cutlery, yarn in weaving, et cetera. Hence the total production shows a seeming exaggeration of the industrial activity, to perfectly correct which is, however, impossible without a minute analysis of all the separate cases. In the absence, then, of more detailed information it may be assumed that the indicated repetitions only in some degree make good the omission of Government and minor industries.

It appears from the above table that to each manufactory or works correspond about 47,500 roubles annual turnover, and about 43 workmen. The average figures show that the minor industrial undertakings do not enter into the number of manufactories and mills here taken into consideration. Besides this, attention should be directed to the fact that some of the Russian manufactories and works, especially cotton mills and metal works, reach very large dimensions. Thus, for example, 18 to 20 thousand workmen are employed in the cotton mill belonging to Savva Morozov at Nikolsk, government of Vladimir. The mills of Zakhari Morozov & Sons, Hill & Ditrich, that at Krenholm, and many others, as also the metal foundries of Demidov, Hughes, and others, also employ thousands of workmen.

Comparing the totals of the two last columns, it appears that on an average each workman corresponds to an annual turnover of about 1,100 roubles in the various mills and manufactories. The proportion per workman is least where the original plant and the raw material are cheap, and much hand labour is required. Such works, especially those connected with mining, evidently taking into account the abundance of cheap workmen and the restricted amount of free capital in the country, have the greatest chance of a successful and useful influence in Russia. Where also the raw material forms a fairly large share of the value of the finished goods, and where there is a great expenditure of mechanical and intelligent energy, a much more considerable amount of annual business corresponds to each workman, namely, two to three thousand roubles.

The figures noted further show that the number of workmen engaged in all the mills, manufactories, and mining industries of Russia does not exceed 1,500,000; in other words, does not constitute more than 1.25 per cent of the inhabitants. This insignificant proportion of the population earning their wages by manufacturing industry proves, like all that has been set forth above, that Russia is only entering into the circle of countries possessing an industrial character.

The primitive historical organization of Russia was principally territorial and political, which arose from the necessity of defending the country and establishing order in it. For this purpose, as has been seen, our people invited Princes to reign over them, and then organised themselves into a Tsardom, and then into an Empire. Thus did the agricultural mode of life of our country grow up under the influence of the principles of territorial security, always combined with a distribution of land.

TABLE 12.

MANUFACTORIES AND MILLS ARRANGED ACCORDING TO ARTICLES PRODUCED, 1890.	Manu- facto- ries and mills.	Production in millions of paper roubles.	Workmen in thousands.
1. Cotton goods (yarn and tissues)	912	346	255
2. Linen goods (scutching, spinning, weaving)	174	41	46
3. Woolen goods (cleaning, wool spinning, weaving, felt, carpets, cloth).	1044	106	95
4. Silk goods (throwing, weaving, brocade).	254	13	18
5. Ropes, oil-cloth, hats, ribbons, knitted and plaited goods made of fibres	509	15	18
6. Writing paper, wall papers	357	27	30
7. Leather and leathern goods	2690	39	24
8. Glue, tallow, wax, stearine, soap, bristles	1159	31	13
9. Gutta-percha	14	11	4
10. Saw mills, furniture, resin connected with wood . . .	1592	40	42
11. Gold (2,500 pounds), platinum, silver, mercury, copper, lead, tin and zinc	1881	58	106
12. Cast iron (56,000,000 pounds)	262	61	233
13. Iron and steel (nails, wire, machinery), copper, bronze, gold and other goods made of metal, and machinery.	1881	186	118
14. Salt (189,600,000 pounds), coal (367,000,000) and other solid minerals.	—	29	86
15. Stone, lime, cement, bricks, porcelain, fayence, plaster of Paris, glass and mirrors.	2345	36	73
16. Chemicals and cosmetics, colours, matches and powder.	846	34	27
17. Petroleum (260,000,000 pounds)	160	27	11
18. Sugar (23,000,000 pounds) spirit, vodka, beer and tobacco	7241	265	189
19. Flour, meal, starch, molasses, macaroni, malt, and sweetmeats.	7061	169	38
20. Other comestibles besides above (vegetable oils, pre- serves, vinegar).	2856	28	11
21. Carriages, musical instruments, pencils	380	35	16
	33683	1597	1453

Having given every peasant the right to land, Russia completed her epoch of the past, and began gradually to enter into the new era of mixed agriculture and industry. The conditions of universal peace and industrial progress which have called forth the World's Columbian Exposition are included in and contribute to, the interests of their new mode of life. The industrial successes of such mighty world units as the United States of America and Russia must contribute mightily to the brotherhood of peoples, under the influence of the all powerful principles of the Christian order of things. The friends of these principles will rejoice over the success of the Columbian Exposition in America, and over the entry of Russia upon the path of industrial progress, because thereby peace is assured from both West und East, as well as brotherly communion, the happiness of the masses, and a bloodless victory over nature, with the aid of the dissemination of that scientific knowledge which has become absolutely necessary for the success of contemporary industry.

D. Mendeleeff.

*St. Petersburg,
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CHAPTER I.

Cotton goods.

THE manufacture of cotton according to its state of development should occupy the first place among other branches of Russian industry. Forming a subject of constant and special consideration by the Government, this industry has developed in magnitude and quality very rapidly, and at the present time has acquired such dimensions that it not only suffices for home consumption, but exports its products to foreign markets in annually increasing quantities.

HISTORICAL REVIEW OF THE INDUSTRY.

The origin of the cotton manufacturing industry in Russia, although on a very small scale, must be dated back to the sixteenth century. The import of Eastern productions, namely, fustian, cotton flannel, domestic, shirting, turkey red, damask, figured counterpanes and tablecloths commenced much earlier. These textures pleased the Russians very much and their aim was to establish the industry in their own country.

Cotton manufacture on an enlarged scale commenced by using foreign imported yarns for textures in the first half of the eighteenth century. The yarn was distributed in the villages to the peasants to be worked up on hand looms into textures in general use among the people, namely, into nankeen, tricot, camlet, Chinese cotton cloth, coarse muslin sailcloth, domestic, shirting, calico, fustian and others. In a short time they began to establish small weaving mills, in appearance like roomy huts with large windows, where they erected from twenty to thirty looms and produced, by hired and piece work, cotton and linen textures. In the middle of the eighteenth century, in the Moscow and Vladimir governments, there was a considerable number of these establishments, and the manufacture of cotton goods began quickly to spread among the villages, displacing the weaving of linen cloths. At this period dyeing and calico printing made its appearance. The foundation of the industry was laid in the village of Ivanova in the

government of Vladimir. The inhabitants of Ivanova in the middle of the eighteenth century, besides agriculture occupied themselves with wool-cleaning and covering linen with oil paints. The first dyeing and calico printing mill was built about the years 1745 to 1750. This mill laid the foundation of printing, at the present time so widely spread in the manufacturing districts of the Vladimir government. At the end of the last century there were already several mills in Ivanova engaged in calico printing on a large scale, while at the same time the manufacture of Turkey red was commenced, which was destined to occupy a prominent position among other manufactures in dyed cotton textures. Turkey red was brought into Russia long ago from Bokhara and Persia, where it was first manufactured. The red textures were very much liked by the inhabitants and the demand became so great that the Bokharans and Persians founded in Russia, in the governments of Astrakhan, Kazan and Viatka several mills. Examining the produce of these mills in the present age a contemporary, a Saxon by birth, named John Vontich, found that in reference to the principles on which Russian tissues were dyed, they should occupy a place immeasurably above those of Western Europe.

From the commencement of the present century the manufacture of calico from English spun yarns began to spread from the Moscow and Vladimir governments into neighbouring parts, although the greater part remained in the Moscow districts, due to their proximity to the Moscow market. The demand for yarns increased so much that attempts were made to build their own spinning mills. The first cotton spinning mill was erected in Moscow in the year 1808 by a merchant, named Panteleyev. It is interesting to note that the machinery for this first Russian cotton mill was of Russian construction. In the same year was started the first power looms at the Alexandrovsk Manufactory in St. Petersburg. Up to the year 1812 the number of cotton spinning mills reached a total of eleven with 780 spinning machines. The military events of 1812 told heavily on the newly established industry and Russian finances, and for some time retarded the further progress of cotton manufacturing, but from the year 1820 it developed rapidly. In 1824 two large cotton spinning mills were opened, one in St-Petersburg and the other in Moscow; and in the third decade the manufacture of cotton tissues increased considerably, attracting a large number of persons and capital. The first cotton spinning mills had to battle with great difficulties in acquiring the necessary machinery, as it is well known that in England, where the construction of such machinery was first commenced, up to the year 1842 there existed a law prohibiting the export of such machinery to foreign countries, the infringement of which law was punishable by death. Notwithstanding these severe measures the machines were smuggled to foreign parts, and thus although with great difficulty, made their way into Russia. In the year 1842 the English Government sanctioned the free export of machinery, and the cotton spinning mills in Russia, as a natural consequence, developed still more rapidly. In 1843 there were 40 mills in Russia with a total of 350,000 spindles. The production of each spindle per year equalled about one pound of cotton yarn. In ten years there were 1,000,000 spindles at work; the product per spindle increased to an average of 48 pounds. The art of weaving, dyeing and calico printing grew simultaneously with that of cotton spinning.

An idea of the gradual development of cotton manufacture in Russia may be

had from the appended diagrams, Fig. 1 showing the import of raw cotton over the European frontier; Fig. 2, yarns and woven goods, knitted, plaited and corded.

Examining the line showing the quantity of imported cotton it cannot be denied that the development of Russian cotton manufacture has advanced with wonderful rapidity. The unchecked growth is broken only in the period between 1861 and 1865, when the import of American cotton to Europe was diminished to an extraordinary degree. Examining the other two lines, import of yarns and goods, it will be noticed that the amount of imports especially increased in the periods 1878 to 1880 and then diminished, but was nevertheless very much less than that of raw cotton. The increased import of yarns of medium counts from 1878 to 1880 was caused principally through the spinners taking advantage of the agitated state of all branches of cotton manufacture after the Russo-Turkish war, and the increased demand for yarns, which raised the prices disproportionately, and therefore obliged the weavers to apply to foreign manufacturers. Comparing the totals of imports of cotton, yarn and textures, one must come to the conclusion that the Russian production almost sufficed for internal wants in cotton manufactured goods. Yarns received from abroad consisted chiefly of fine counts the production of which in Russia was very small; they were used mostly for mixed and fine stuffs. The amount of imported yarns and textures when compared with the home product is very insignificant. To be convinced of this it is sufficient to compare the quantity of cotton received with that of yarns and textures.

FIG. 1.

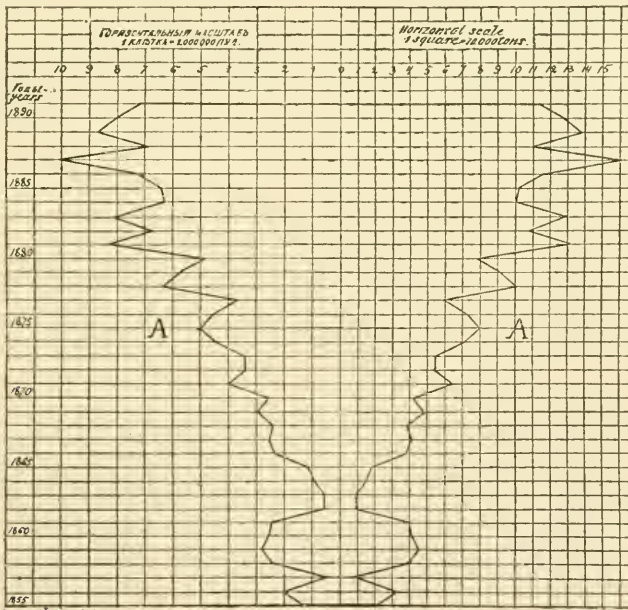


Fig. 1. Diagram of cotton imported over the European frontier, the left side showing millions of pounds; the right side, tens of thousands of tons. To complete the information given in the diagrams the following table is appended :

A. AMOUNT OF CUSTOM DUES.

Y E A R S.	RAW COTTON.	Y ARNS.	MANUFACTURED GOODS.
	Roubles paper per pound.		Roubles paper per pound.
1855—1857	0.25	6.50 to 15.20	0.83 to 7.20
1857—1868	0.25	3.50 > 5.00	0.35 > 2.00
From 1868. . . .	Free.	3.25 > 4.25	0.28 > 1.20
IN 1877 THE PAYMENT OF DUTIES IN GOLD WAS INTRODUCED.			
	Roubles gold per pound.		Roubles gold per pound.
1877	Free	3.25 to 4.25	0.28 to 1.20
1879—1881	0.40	3.25 > 4.25	0.28 > 1.20
From 1882	0.45	3.60 > 6.00	0.31 > 1.32
> 1885	1.00 to 1.15	3.60 > 7.00	0.31 > 1.32
> 1891	1.20 > 1.35	4.20 > 11.00	0.31 > 1.32

B. AVERAGE ANNUAL QUANTITY AND VALUE OF IMPORTS.

Y E A R S.	RAW COTTON.			Y A R N S.			MANUFACTURED GOODS.		
	Millions of pounds.	Millions of English pounds.	Value in millions of dollars.	Millions of pounds.	Millions of English pounds.	Value in millions of dollars.	Millions of pounds.	Millions of English pounds.	Value in millions of dollars.
1877—1881 . .	5.8	210	31	0.497	17.9	9.3	0.067	2.4	2.4
1882—1886 . .	6.9	249	39	0.218	7.9	5.1	0.053	1.9	1.8
1887—1891 . .	8.1	293	41	0.225	8.1	4.4	0.030	1.1	0.9

FIG. 2.

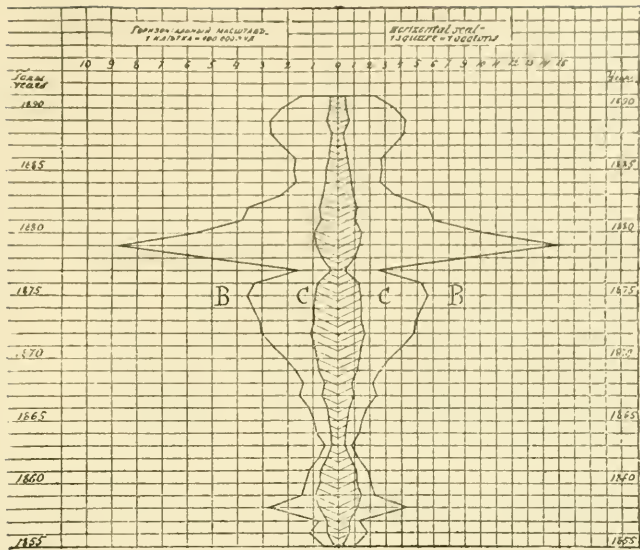


Fig. 2. Diagram showing imports by European frontiers: B, yarns; C, goods; left side, showing hundreds of thousands of pounds; right side, thousands of tons.

The relative amount in weight of imported yarns and goods to that of cotton consumed by spinning mills, is as follows:

Y E A R S.	I M P O R T E D.	
	Yarns.	Goods.
1855—1859	8 per cent	5 per cent
1860—1864	6 >	5 >
1865—1869	5.5 >	3.5 >
1870—1874	7.6 >	4 >
1875—1879	8.5 >	2 >

From the above it will be seen that the Russian cotton manufacture during the years above mentioned increased to such an extent that the relative percentage of imports of yarn and cotton scarcely varied, but that the importation of cotton goods gradually decreased, and at the end of the seventh decade had sunk into insignificance. During the same period the exportation of Russian goods to Persia and Central Asia was more or less noticeable, and the import of Asiatic cotton increased.

Having traced the general development of the manufacture of cotton it will be interesting to turn to its detailed characteristic condition for the last fifteen years.

QUANTITY OF COTTON CONSUMED, ITS CLASSIFICATION AND QUALITY.

The import of cotton over the European frontier is shown in the following figures from official statistics:

YEARS.	Pounds.	Paper roubles.	YEARS.	Pounds.	Paper roubles.	YEARS.	Pounds.	Paper roubles.
POUNDS AND PAPER ROUBLES GIVEN IN THOUSANDS.								
1877 . . .	3,680	35,324	1882 . . .	6,710	72,417	1887 . . .	10,056	96,436
1878 . . .	6,330	67,894	1883 . . .	8,090	93,864	1888 . . .	6,890	68,248
1879 . . .	5,720	60,004	1884 . . .	6,277	76,176	1889 . . .	8,620	83,509
1880 . . .	4,887	51,951	1885 . . .	6,378	65,967	1890 . . .	7,995	79,121
1881 . . .	8,217	84,499	1886 . . .	7,248	71,986	1891 . . .	7,131	69,397
Average . .	5,767	59,934	Average . .	6,941	76,082	Average . .	8,138	79,342

Besides this during the period of 1887 to 1890 there were imported over the Asiatic frontier on an average about 900,000 pounds valued at 6,000,000 roubles. In this manner, the yearly imports of foreign cotton into Russia over both frontiers amounted latterly to 9,000,000 pounds. The foreign statistics refer to the import of American, Egyptian, East Indian and Persian cottons.

As regards the import of cotton from the Asiatic possessions of Russia, the consumption of which has rapidly increased, it is exceedingly difficult to give entirely trustworthy data on account of the absence of correct official information on the subject. Of the quantity of cotton supplied by the Russian possessions in Central Asia one can form an idea from the following statistics given of the annual production of the Russian plantations. Ginned cotton was obtained in Turkestan of late years as follows:

FROM AMERICAN SEED.	FROM NATIVE SEED.
1884 10,000 pounds.	1888 476,784
1885 30,000 "	1889 580,055
1886 100,000 "	
1887 212,000 "	
1888 561,612 "	
1889 608,325 "	
1890 900,000 "	

From local statistics during the year 1892 there were 2,000,000 pounds of cotton gathered. It must be noted that part of the cotton from Central Asia goes for local consumption, and is worked up at home by the inhabitants.

Besides this Khiva and Bokhara supply annually for Russian manufacture about 1,000,000 pounds. The Russian spinning mills are also supplied with cotton from the

plantations in the Caucasus, which recently has reached the amount of about 400,000 pounds; thus the total amount of cotton worked up in Russia latterly is approximately estimated at 11,500,000 pounds, or about 185,000 tons. The greater portion of this quantity, about 9,000,000 pounds, falls to the lot of American, Egyptian, East Indian and Persian cottons, the lesser portion, about 2,500,000 pounds, consists of cotton from the Tashkend, Kokhand, Khiva, Bokharan and Caucasian cotton-growing districts. The different kinds of imported cotton used by the Russian manufactories are principally these: Upland, Texas, Sayannah, Orleans, Mobile, white and brown Egyptian; and from East India, Dharwar, Broach, Dhollehah, Oomra, Veravul, Bengal, and Tinnevely. Those principally used are: middling, good middling and middling fair; the higher grades are used in smaller quantities.

Without dwelling on the generally known properties of the above mentioned kinds of cotton, it will be remarked in reference to Bokharan, Khiva, Samarkand, Tashkend, and also Caucasian cottons, that they are very similar to one another and are related to cottons of short and medium staples, and in quality are like the cottons of East India. The length of staple is unequal, and the fibres are rather coarse. The longest stapled cotton is that of Tashkend grown from American seed, and which for certain classes of yarn is preferred to the American. In colour it is white, with a yellowish tinge; in length, 20 to 27 millimetres, rather coarser than American, stronger but is not so clean. American cotton being softer forms a splendid material for weft. The Tashkend cotton is very suitable for preparing twist. Caucasian cotton, grown from fresh American seed, may be considered, as regards quality, as a very suitable material for spinning low and medium counts of yarn. Latterly, a visible improvement has shown itself in the matter of imperfect ginning and bad packing. The general wants of the Russian people in cotton manufactures are supplied almost completely by home productions, as is seen by the following statistics of import of foreign goods.

All kinds of unbleached, as well as bleached and dyed, and also sewing and knitting yarns imported in recent years are indicated below:

Years.	Pounds.	Paper roub- les.	Years.	Pounds	Paper roub- les.	Years.	Pounds.	Paper roub- les.
POUNDS AND PAPER ROUBLES GIVEN IN THOUSANDS.								
1877	158	5,987	1882	355	15,223	1887	219	9,644
1878	504	18,768	1883	226	10,438	1888	263	10,026
1879	875	30,428	1884	166	8,542	1889	271	9,836
1880	568	20,785	1885	174	7,775	1890	228	8,669
1881	381	14,276	1886	169	7,690	1891	145	4,904
Average. . .	497	18,049	Average. . .	218	9,934	Average. . .	225	8,604

On the strength of the foregoing statistics it must be confessed that the import of manufactured cotton yarn, if the home production be taken into consideration, is

very insignificant. The production of Russian cotton spinning mills of late years, has been 10,000,000 pounds of yarn annually, and consequently the import of foreign goods into Russia is only two and a half per cent of the home production. The principal receipts, as shown by the customhouse accounts, are sewing, knitting and also doubled yarns, prepared from fine counts, of which little is produced in Russia. As regards the import of low counts, below № 45, which form the principal part of Russian production, the amount imported is very small. The manufacture of sewing cotton has recently developed in Russia and promises soon to meet the home demands. The import of manufactured cotton goods is less significant than the import of yarns, in relation to the quantity of such goods manufactured in Russia.

For the last fifteen years, the imports were as follows:

Years.	Cotton tissues, gray, white coloured and checked, excepting those dyed in Adrianople red.		Cotton cord- ing, knitting and plaiting goods.		Years.	Cotton tissues printed and dyed in Adrianople red.		Cotton velvet, plush and rib- bon velvet.	
	Pounds.	Paper roubles.	Pounds.	Paper roubles.		Pounds.	Paper roubles	Pounds.	Paper roubles.
POUNDS AND PAPER ROUBLES GIVEN IN THOUSANDS.									
1877	11.9	765	9.1	678	1877	6.0	462	1.4	130
1878	28.9	1,884	20.0	1,352	1878	11.1	984	4.0	429
1879	36.5	2,266	26.0	1,772	1879	15.5	1,344	5.2	602
1880	42.2	2,220	26.0	1,688	1880	16.2	1,407	6.7	703
1881	34.2	1,983	22.0	1,443	1881	0.5	676	5.1	604
Average. . .	30.7	1,824	20.6	1,357	Average. . .	11.5	975	4.5	494
1882	29.6	1,839	27.0	2,018	1882	12.6	1,126	4.2	458
1883	30.6	1,648	15.0	1,018	1883	10.7	879	3.6	339
1884	26.9	1,555	11.0	686	1884	8.8	840	3.0	304
1885	24.0	1,332	8.9	588	1885	7.6	698	3.6	318
1886	21.1	1,167	7.1	466	1886	5.3	397	3.0	253
Average. . .	26.4	1,503	13.8	955	Average. . .	9.0	788	3.5	340
1887	18.4	926	6.1	408	1887	3.9	282	2.7	226
1888	14.5	768	4.9	353	1888	3.0	232	1.8	167
1889	20.4	1,104	7.7	517	1889	4.6	333	2.0	180
1890	19.3	1,014	6.4	413	1890	5.5	381	1.1	97
1891	16.2	818	6.0	388	1891	5.5	391	1.3	109
Average. . .	17.8	926	6.2	416	Average. . .	4.5	324	1.8	156

From this it is seen that the import of manufactured cotton tissues has been for a long time very small, and that it gradually decreases in all sections. If the yearly returns be taken of home production at 9,600,000 pounds of manufactured cotton

goods, then the relative import of foreign manufactures in recent years must be estimated at the following rate: imported gray, bleached and dyed goods, excepting goods dyed Adrianople red, 0.2 per cent; printed and dyed in Adrianople red, 0.05 per cent; velvet, plush and ribbon velvet, 0.02 per cent: total amount of imported textures, 0.27 per cent. Thus the import of cotton manufactured tissues of foreign make form an insignificant item in comparison with the Russian production, and do not exceed one three-hundredth part of the whole of the Russian consumption. In reference to the value of imports, taking the produce of the Russian cotton manufacturing industry of late years approximately at 340,000,000 roubles, it must be presumed that the value of foreign cottons imported form about 25 per cent; yarns, 2.5 per cent: goods, about 0.05 per cent; total, about 28 per cent of the value of goods produced by the Russian manufactories. In valuing the statement of imports the export trade must be taken into consideration. Russia exports manufactured cotton goods principally to Turkey, Bulgaria, Roumania, Persia and China. The most important export trade is carried on with Persia, whose demand for Russian manufactured goods yearly increases. Of this fact one may be convinced by the following statistics.

In 1883 the imports to Persia of Russian manufactured goods scarcely reached 5,200 pounds, while of late years there have been exported:

	1887.	1888.	1889.	1890.
Pounds . . .	18,934	24,867	26,306	31,241.

Therefore, recently the exports have been six times greater than they were in 1883. Comparing the totals of foreign Russian trade it must be acknowledged, in respect to quantity, that the export of Russian manufactured cotton goods fully covers the import of goods of foreign make.

THE YEARLY RETURNS OF THE INDUSTRY.

From data collected by the Department of Trade and Manufacture, the output of the cotton manufacturing industry of Russia for late years is shown by the following figures:

YEARS.	Spinning.	Weaving.	Printing and dyeing	Finishing	Total.
IN MILLIONS OF ROUBLES.					
1880. . . .	74.1	99.7	61.1	5.5	240.4
1881. . . .	89.3	124.6	58.4	2.9	275.2
1882. . . .	99.3	137.5	60.7	3.3	300.8
1883. . . .	97.6	116.7	60.4	3.2	277.9
1884. . . .	91.4	109.3	58.8	2.8	262.3
1885. . . .	97.4	98.0	59.5	3.3	258.2
1886. . . .	93.9	107.2	47.8	3.9	252.8
1887. . . .	105.7	104.3	63.7	4.4	278.1
1888. . . .	133.6	157.2	75.3	4.7	370.8
1889. . . .	187.6	222.3	72.8	4.1	487.1

The above mentioned figures cannot be taken as quite correct, as it is impossible to accurately divide the industry into all its departments because, besides separate spinning, weaving and dyeing mills, there exist many manufactories embracing two or three of these branches, whilst the report of the yearly output of each branch in such manufactories is not given, but taken in totals. A more accurate valuation of the product of the cotton manufacturing industry may be formed by the following calculations. The yearly amount of cotton used by the spinning mills is about 11,500,000 pounds. The yarns spun in Russia are principally of medium and low counts, so that their average ranges between Nos. 23 to 28, which gives about 35 pounds of yarn per pound of cotton (87.5 per cent). 1.75 pounds of waste (4.4 per cent), and 3.25 pounds of dead loss (8.1 per cent). Thus the general production of cotton spinning mills may be accurately taken at ten million pounds. Out of this quantity 9,600,000 are converted into tissues which, taken at an average price of thirty-five roubles per pound for finished goods, forms a sum of about 340,000,000 roubles. Part of the remaining quantity goes for other purposes and part is lost in the manufacture of tissues. Therefore, not taking into consideration the accessory products, as wadding and preparation of knitting yarns and others the value of which is of no great amount, the production of the Russian cotton manufacturing industry may be estimated at 340,000,000 roubles.

TECHNICAL MEANS OF MANUFACTURE.

As regards the technical means possessed by the Russian cotton industry, the number of spindles and power looms in European Russia are shown in the table on page 11. as well as the number of mills, in 1877 and in 1886, with their distribution in the Empire, and the information given may be considered as thoroughly authentic.

The number of working hours in Russian manufactories is not uniform, but varies from twelve to twenty-four hours per diem. The number of working days during the year may be estimated approximately at 280. In foreign mills, in the majority of cases, the number of working days is estimated at 300, of ten hours each. Out of the total number of spindles and looms in Russian mills in 1877 there were at work:

Time.	Spindles.	Looms.
24 hours per day. .	1,489,851	41,037
12 " " " " .	1,306,432	13,529

Converting these figures to an equivalent of 300 days of ten hours work, the results will be 4,800,470 spindles and 107,075 looms.

In 1886 there were at work:

Time.	Spindles.	Looms.
13.5 hours	2,322,090	42,335
18 " " " " .	641,590	12,577
21 " " " " .	272,986	7,067
24 " " " " .	456,788	17,835
Not at work . . .	219,352	4,702

Districts.	GOVERNMENTS.	Number of mills.			NUMBER OF SPINDLES.								Number of power looms.	
		1877. 1886.			1877.			1886.			1877. 1886.			
		Spinning.	Weaving.	Spinning.	Mule.	Throstle.	Total.	Mule.	Flyer.	Ring.	Total.	1877	1886.	
M o s c o w.	Moscow	18	35	24	34	615,382	25,014	610,126	811,608	2,624	146,474	960,706	16,283	24,205
	Vladimir	10	29	11	36	353,934	48,764	402,698	424,558	20,420	92,616	537,594	13,421	20,957
	Tver	4	5	5	6	182,560	28,096	210,656	182,628	18,984	33,572	235,184	5,053	5,139
	Yaroslav	1	1	2	1	99,462	4,988	103,550	177,920	—	11,824	189,744	944	1,002
	Riazan	1	3	1	4	68,769	26,420	95,189	118,000	3,400	19,400	140,800	349	1,693
	Smolensk	1	1	1	1	26,676	—	26,676	36,724	—	29,568	66,292	500	750
	Kostroma	—	9	1	15	—	—	—	23,704	—	4,458	30,192	3,675	6,716
	Kazan	1	1	—	—	5,564	—	5,564	—	—	—	—	35	—
	Kaluga	1	—	—	—	4,200	—	4,200	—	—	—	—	—	—
Total in Moscow districts.		37	84	45	97	1,356,547	132,412	1,483,959	1,777,112	45,428	337,912	2,160,512	40,260	60,522
Petersburg.	Kherson	—	—	1	1	—	—	—	2,400	7,788	480	10,668	—	122
	Tiflis	—	—	1	1	—	—	—	5,600	—	5,200	10,800	—	284
	Perm	1	1	—	—	2,100	400	2,500	—	—	—	—	75	—
	Total in St. Petersburg districts.	13	10	12	11	691,604	58,516	750,120	666,392	28,482	97,104	791,978	6,606	8,554
Petersburg.	Baltic Provinces	4	3	4	3	173,896	107,592	281,488	229,986	108,172	9,904	318,362	2,016	2,237
	Total in St. Petersburg districts.	17	13	16	14	865,500	166,108	1,031,608	896,378	136,954	107,008	1,140,340	8,622	10,791
	Vistula districts	9	6	13	8	173,480	43,160	216,640	379,248	26,886	99,518	505,622	4,417	10,572
	Finland	3	2	3	2	16,500	40,076	56,576	30,884	45,120	8,860	84,864	1,192	2,225
Total		67	106	79	123	2,414,127	382,156	2,796,283	3,091,652	262,146	559,008	3,912,806	54,566	81,516

From the above quotations a similar calculation would find 5,561,962 spindles and 128,273 looms. Thus for the last ten years the number of spindles has increased approximately sixteen per cent and the number of looms, twenty per cent. At the present time the number of spindles in Russia may be estimated at 6,000,000 and the number of looms at 200,000, taking 300 days per annum of ten working hours.

Speaking of the technical means of production it will be interesting to become acquainted with the number of workpeople engaged in the cotton manufacturing industry. According to statistics for 1889 there were employed in the spinning and weaving mills 211,000 people; out of this number 110,000 hands were engaged in weaving for 200,000 looms, and about 100,000 in spinning for 6,000,000 spindles. In this manner it results that there are in Russia about two looms and sixty spindles per workman. In comparing the relative production with that of England it will be seen that there is more labour spent in Russia than in England, but it would be erroneous to explain this fact by attributing it to the comparative incapability of the Russian workpeople, as on the contrary they must be credited with great ability and endurance. In fixing the relative amount of labour dependent on the number of spindles and looms it is necessary to take into consideration the commercial side of the question, the influence of which is the principal cause of the above mentioned difference. Although in both countries the same ends are aimed at, namely, to attain the cheapest production, in consequence of the different conditions of labour, in England machinery being cheap and labour dear and in Russia *vice versa*, it is attained by different means. This can be easily seen by examining the working of spinning machines and looms. In England the carriages of self-acting mules make fewer stretches per minute than those working in Russia, in consequence of which the production of the machine is reduced, but at the same time there are fewer broken ends, which reduces the amount of labour required. By this means the loss in production is recompensed by the smaller amount paid for labour. In like manner in Russian mills the number of picks made by the looms per minute is greater than those in the English manufactories, calling for greater manual labour for piecing broken ends in the warp and changing weft caps, so that an English workman can be entrusted with four looms or more, while a Russian, in consequence of the higher speed, cannot be given more than two.

COMPARISON OF RUSSIAN AND FOREIGN INDUSTRIES.

To be able to determine the position occupied by the Russian cotton industry amongst foreign industries, a comparison should be made of the technical means possessed by the different nations and the quantity of raw cotton used. From statistics given by Thomas Ellison, of recent years the number of spindles in the world may be seen by the following figures:

	1881.	1884.	1886.	1888.	1891.
	SPINDLES GIVEN IN THOUSANDS.				
England	40,600	42,750	42,700	42,740	44,000
The Continent.	21,245	22,650	22,900	23,380	25,050
Total in Europe.	61,845	65,400	65,600	66,120	69,050
United States.	11,375	13,300	13,400	13,550	14,774
East India	1,513	2,002	2,262	2,489	3,352
World's Total.	74,733	80,702	81,262	82,159	87,176

In the year 1870 the number of spindles was estimated at 70,334,000, so that during a period of twenty years they have increased 22 per cent, and for the last ten years the increase has been nearly 17 per cent. The number of spindles in Russia form about one-quarter of those of the continent of Europe and about one-seventh of those of England. The distribution of spindles in the European powers is as follows:

England	44,000,000	Germany	5,000,000
Russia	6,000,000	Switzerland	1,850,000
France.	5,039,000	Austria	2,093,000

Thus in quantity of spindles Russia occupies the first place in Europe after England.

The amount of cotton used in the world in the seasons of 1890 and 1891 was as follows:

England	4,270,000 bales (400 English pounds).				
Continent of Europe.	4,480,000	»	»	»	»
Total in Europe	8,750,000	»	»	»	»
United States	3,171,000	»	»	»	»
East India	1,058,400	»	»	»	»
World's total	12,979,400				

Taking into consideration that in Russia about 11,500,000 pounds, that is, about 1,040,000 bales of 400 English pounds each are worked up annually, it is seen that the Russian industry consumes about one-quarter the amount used in English manufactories. The yearly consumption of cotton per spindle in England is 36.4 English pounds; in Russia, 69.2 English pounds; on the continent in general, 69 English pounds; in the United States, 76 English pounds. The above comparison shows that the amount of raw cotton used in Russia per spindle is nearly double that of England. The reason of this is that in England fine counts are spun, as well as medium and coarse, whereas in Russia spinning is principally devoted to medium and low counts of yarn.

CHARACTERISTICS OF THE INDUSTRY.

The Russian cotton spinning industry, in general, does not go beyond the spinning of medium numbers and is limited to № 70. The annual average counts are 28, approximately. The chief portion of yarns spun forms Nos. 30 to 34 twist, and Nos. 34 to 38 weft. In Russia the English system is adopted for numbering cotton yarns, that is, the counts are arrived at by the number of hanks of 840 yards each per English pound. These numbers are used for the manufacture of calico, which is finished by bleaching, dyeing and printing. Fine counts are made in a comparatively small quantity, although of recent years progress has been made in this direction. Many of the existing spinning mills have commenced spinning fine counts; moreover, new mills have been erected especially for this purpose and spin up to Nos. 125 and 130, doubling them into sewing cottons or supplying weaving mills for the manufacture of mixed goods. The competition in manufacturing fine counts and sewing cottons in Russia is limited to the English manufacturers, such as Coats, Clark, and others, to compete with whom is a matter of great difficulty. Consequently the whole of Russian cotton spinning must be classed as medium and low counts. Generally speaking the Russian spinning mills do not make a specialty of spinning certain counts; each mill, in the majority of cases, produces a whole assortment of numbers striving more or less to get the full amount of yarn out of a given quantity of raw cotton. In conformity to this, mixings of cotton are prepared from which different numbers of yarn are made, for instance: for mule weft, Nos. 6 to 10, American cotton is used, or a mixture of Asiatic cotton with waste; for Nos. 30 to 50 twist, American or Egyptian; for weft, Nos. 30—50 American, or Nos. 60—70 Egyptian; for throstle spinning, Nos. 12 to 18, Asiatic or Nos. 22 to 40, American or Egyptian, and so forth. Cotton tissues fabricated in Russia consist principally of prints and self colours, Turkey red, and the minor part, of bleached goods. The printed goods of Russian manufacture in all respects answer the demands of modern times. With the great variety of colours and styles of finish, they are capable of satisfying the buyer of refined and ordinary tastes. The printed goods of the Moscow and Serpoukhov mills may be fearlessly placed on a par with similar goods from the best Mulhausen and Rouen print works. As regards calendered and red prints, which have such a widespread sale throughout the Empire and also in the neighbouring Asiatic possessions, they may be said to have justly earned a good reputation among foreigners.

It must be remembered with regard to the characteristic development of Russian industries for the last twenty years that, besides the improvement in quality, the manufacture of cheap and heavy goods has developed at the same time, which to a certain extent is able to compete with woollen goods and like prints, and supplies the wants of the poorer classes of inhabitants. The above product takes the form of heavy, printed goods, such as printed fustians, cotton cloth, tricot and others, the manufacture of which was copied from Saxony and first made at the Pabianitsk mill. Kroushay, in the Polish district, which was converted in 1873 from a shoddy mill into that of cotton manufacturing. The material thus manufactured is taken in the unbleached state and dyed in dark colours, after which it is printed upon in still darker shades. These fustians began to spread rapidly among the poorer classes of consumers, and as the demand for printed fustians yearly increased the Pabianitsk manufacturers began to

have competition in neighbouring mills, as well as in the Moscow districts. Then, to the manufacture of printed fustians was added that of printed cotton cloth, or buckskin, which at once found a good sale amongst the poorer classes, displacing similar goods made from wool. In the manufacture of such goods, Nos. 14 to 20 twist and Nos. 2 to 8 weft are used. These tissues are very heavy, a piece of unbleached fustian 50 arshines long and 1 arshine wide weighing about half a pound, and also very dear considering the material contained in them.

With a view to reducing the cost in the fabrication of these goods the manufacturers use weft made from all kinds of cheap materials, namely: the waste and droppings which result during the processes of scutching, carding and spinning, and which are of such short and unequal staple, that their further use for spinning into yarns, with the ordinary assortment of cotton spinning machinery, is rendered either unprofitable or quite impossible. With the adoption of an assortment of machinery, the same as is used for shoddy, for the working up of this raw material, it is possible to produce a cheap waste yarn quite suitable for weft, for fustians and buckskins, but especially for fustians. As this texture passes through a process of raising, a better nap is formed when weft is used prepared in the before-mentioned manner. Thus, the fabrication of heavy printed goods caused a special manufacture of weft yarn from waste, in the making of which large manufactories, as well as special waste-spinning mills, are occupied. This industry spread so rapidly soon after its appearance, that there was an insufficiency in the amount of cotton waste, which at first was supplied solely by local cotton spinning mills. This waste, consisting of willow, clearer, roller, doffer and cylinder strips, was then imported from England, where it is of little value. With the tariff of 1891 the importation of cotton waste was made very difficult, and this circumstance compelled the manufacturers to use low classes of cotton mixed with the waste from local cotton mills for the production of waste yarn.

With the cotton-spinning industry should be coupled the manufacture of vigone yarns, which are made from a mixture of dyed cotton, most frequently black and brown, and wool, in which mixture the amount of wool varies from 2 to 10 per cent. The cheaper kinds are made from a mixture of dyed and undyed cotton, or in place of the latter, bleached flax waste is substituted. The manufacture of vigone yarns was first commenced in Verdan and Crimnitzschau in Saxony, whence it was brought into Russia in 1879, when at the close of the Turkish war several of the Saxon manufacturers transferred the new industry to the Polish manufacturing regions. Vigone yarns are made on exactly the same class of spinning machines as those used in the manufacture of woollen yarns. As regards the construction and size of vigone mills, they are in every respect the same as those for woollen manufacture and are of no considerable dimensions. Taking these facts into consideration it was an easy matter during the depression in the woollen trade for several manufacturers to convert their mills into those for the spinning of vigone yarns.

COST OF PRODUCTION OF COTTON MANUFACTURES.

The cost of production of cotton yarns of medium numbers in Russia is from 9 to 12 kopecks per count per pound, so that the cost of production of one pound of

twist yarn, № 32, is from 32×9 kopecks to 32×12 kopecks, that is, from 2.88 to 3.84 roubles; these costs are taken from the yearly balance sheets. To show the different items forming the cost of production, statistics are given, which are more or less adapted to the large cotton spinneries, reckoning per pound of yarn:

	Moscow district.	Petersburg district.
	Counts of yarn.	
	25	24
Fuel, per pound of yarn	90 kopecks	53 kopecks
Wages	75 >	81 >
Oiling	2.5 >	8 >
Lighting	3 >	5 >
Card clothing, banding, strapping, roller skins, bobbins	22 >	21 >
Re-mount of machinery, including materials	25 >	23 >
Administration	10 >	
Re-mount, mill buildings, barracks, hospitals, schools and Government taxes.	50 >	57 >
Total. . . .	2.775 roubles	2.48 roubles

That is, per count per pound about 10 to 11 kopecks would be the cost.

In the Polish districts the cost of production for medium counts, № 26, is about 10.5 kopecks per count per pound, in which the principal items are 38 kopecks for fuel and 1.08 roubles for wages. In comparing the foregoing statistics it will be seen that although the various items differ in the cost of producing yarn, still the totals in the three manufacturing districts are nearly the same. The principal difference lies in the price of labour and cost of fuel. The Polish district has the advantage in respect to the cost of fuel, having rich coal mines in the Petrokovsk government. The Petersburg district is not so advantageously situated, having to use coal imported from England, and the Moscow district, where turf, wood, naptha and coals are principally used, labours under still greater disadvantages. According to official statistics given in 1889 the consumption of fuel in the cotton spinning manufactories in the Moscow and Vladimir governments, if the caloric co-efficiencies be taken into consideration, was, wood, 24.25 per cent; turf, 38 per cent; coal, 8.5 per cent, and naptha residues, 29.25 per cent. The price of wood in the Moscow government increases yearly and varies from 11.6 to 13.1 kopecks per pound; turf, the use of which is rapidly increasing in the mills in the vicinity of Moscow and which has now reached an annual consumption of more than 100,000 cubic fathoms, owing to the high rate of transit costs as much as 12 and even 16 kopecks per pound, pressed and dried. Manufacturers here expend large sums of money, which may be considered as so much dead capital, in acquiring forests and in buying or renting bogs. Moreover, wood and turf are transported cheaply and conveniently only during the winter months, consequently manufacturers are compelled to lay in supplies of this fuel sufficient to last them a considerable time, as is not the case in the Polish district where coal is obtainable during the whole of the year.

With regard to the price of labour it is highest in the Polish and lowest in the Moscow districts, as will be seen by the following particulars regarding the weekly wages of workmen in the different departments of cotton manufactories.

WORKMEN.	Moscow district.	Polish district.
	R O U B L E S.	
Mixing room	1.75 to 3.00	3.00 to 4.00
Scutching room	1.75 3.00	3 80 4.80
Card „	1.75 2.50	4.00 5.00
Spinners „	4.00 7.50	8.50 9.00
Piecers „	2.75 3.50	2.80 3.50
Creelers „	1.80 2.75	2.00 3.00
Reelers „	1.30 3.75	3.40 4.00
Packers „	— — — —	2.50 3.00
Weavers „	2.00 3.80	4.00 7.00

The cost of production of cotton tissues in general use, including depreciation and sinking of capital, is as follows :

NAMES OF GOODS.	Width in ar- shines.	Number of arshines per pound.	COUNTS OF YARN.		VALUE PER POUND OF GOODS.			Price per arshine.
			Num- ber of warp.	Num- ber of weft.	Yarn.	Produc- tion.	Total.	
					R O U B L E S.			
Calico	4/4	290	32	34	16.50	4.35*	20.85	7.3
»	5/4	264	32	36	16.50	4.50	21.00	7 9
»	4/4	400	32	38	16.80	5.20	22.00	5.5
Cashmere	4/4	238	26	12	13.20	2.40	15.60	6.7
»	5/4	132	26	8	12.80	2.40	15.20	11.5
Etoile du nord.	4/4	304	32	32	17.80	5.20	23.00	7.6
Fancy	4/4	268	36	32	17.30	8.00	25.30	9.4
Brilliantine	4/4	296	32	36	18 00	8.00	26.00	9.0
Domestic	4/4	216	26	14	14.05	2.70	16.75	7.7
Cord	4/4	184	32	18	15.60	3.70	19.30	10.5
Diagonal	4/4	184	26	18	15.30	3.70	19.00	10.3
Fustian	4/4	140	26	8	15.10	2.40	17.50	12.5

* The average cost of production per piece (90 arshines) of 8 pound calico (that is, a piece weighing eight pounds), consists of the following items: weavers wages, 30 kopecks; other wages, 13 kopecks; administration, 5 kopecks; materials, 10 kopecks; general expenses, 30 to 35 kopecks; total, 90 to 95 kopecks.

To be able to estimate the cost of bleached, dyed and printed goods, the cost of bleaching, dyeing and printing must be added to the price of the goods in the raw state, and the loss of weight and waste during the above-named processes must be taken into consideration. The cost of bleaching, dyeing and printing cotton goods of medium quality in general use is shown in the following figures. In all the under-mentioned calculations a piece of calico is taken, 14 vershocks wide (24.4 inches) of 850 dents to the reed, 60 arshines long and 7 pounds in weight. Bleaching costs from 18 to 25 kopecks per piece.

The cost of dyeing in different colours depends upon the class of dyes used, reckoning per arshine of tissue: dark indigo, about 5 to 6 kopecks; medium indigo, 2.75 kopecks; light indigo, 2 kopecks; smooth red alizarine, 3 kopecks; smooth cardinal alizarine, 2.5 kopecks; bordeaux or garnet alizarine, 2.5 kopecks; bistre, dark shade, 1.7 kopecks; aniline black corrodent, 2 kopecks; red congo and benzo-pourpourine, 2 kopecks; naphthol of different shades and colours, 1.5 kopecks; garnet or bordeaux, dyed with fuchsin, grenadine, or Bismack, 2.5 kopecks; lilac and violet, 2.75 kopecks; azure and dark blue, 2 to 2.75 kopecks; green, 2.25 kopecks. For printed goods it is difficult to give any general or average figures as the fluctuation in the cost of manufacture is very great and depends, firstly, on the amount of printing colours used, which in turn depends on the character of the design and the depth to which the printing rollers are engraved; secondly, on the price of the colours used; thirdly, on the number of times the printed matter passes through the machine, and the number of different processes it undergoes before it reaches a finished state. It can be stated, but approximately, that the cost of printing at the majority of Russian print works is from 1.75 to 6 kopecks per arshine, and for the more predominant kinds, from 2.5 to 3 kopecks per arshine.

PRICES OF COTTON AND COTTON MANUFACTURES.

In order to explain the commercial side of the Russian cotton manufacturing industry, the commercial value of raw cotton and cotton goods is given below.

PRICES OF RAW COTTON.

Years.	Price in England * in roubles gold per pond.	Average exchange.	Price in Moscow ** in roubles gold per pond.	Difference in price between England and Moscow.
1884 . . .	5.81	1.58	6.83	1.02
1885 . . .	5.51	1.61	6.36	0.86
1886 . . .	4.84	1.65	5.89	1.05
1887 . . .	5.16	1.81	6.18	1.02
1888 . . .	5.29	1.72	6.96	1.67
1889 . . .	5.65	1.50	7.51	1.86
1890 . . .	5.96	1.40	7.70	1.74

* Middling Upland cotton.

** Average prices of classes of American cotton, quoted on the Moscow exchange.

Annual average prices for cotton yarns and calicos in Moscow, from quotations on the Moscow exchange.

Years.	Nos $36/38$ weft per poud.	Nos $38/40$ weft per poud.	Nos 34 twist per poud.	Calico 20 vershoks per arshine.	Calico 15 vershoks per arshine.
P A P E R R O U B L E S.					
1877 . . .	—	15.99	16.50	0.0775	0.07
1878 . . .	—	19.82	21.52	0.10	0.085
1879 . . .	—	21.13	21.14	0.11	0.105
1880 . . .	—	19.63	20.49	0.1225	0.075
1881 . . .	19.06	18.90	18.94	0.1175	0.0775
1882 . . .	18.26	18.82	19.02		0.0675
1883 . . .	15.87	16.16	16.52	—	0.055
1884 . . .	15.48	15.93	16.28	0.095	0.055
1885 . . .	15.81	16.45	16.41	0.09	0.0625
1886 . . .	15.99	16.66	16.50	0.0925	0.0575
1887 . . .	18.48	18.96	19.65	0.1125	0.0725
1888 . . .	20.11	20.99	21.17	0.11	0.0675
1889 . . .	17.07	17.54	17.78	0.09	0.06
1890 . . .	16.14	16.65	16.82	0.09	0.0575

The Russian cotton manufacturing industry benefits by a large customs tariff, levied to protect it from foreign competition. It is possible that this protection has caused consumers to make sacrifices to the Russian manufacturers, but these sacrifices are doubtless recompensed by a visible gain to the native industries. Cotton manufactured goods are articles, supplying not a whim, fashion or luxury but an actual necessity, and the fabrication of them gives large earnings to the inhabitants, as in the cost of production wages occupy the first place. Considering that each workman earns annually about 200 roubles, it may be seen that the amount of wages paid yearly by cotton manufacturers to 211,000 workmen amounts to about 40,000,000 roubles. Besides supplying the people with work the trouble taken by the Government to develop home manufacture is amply rewarded, as may be seen by simple calculations. The requirements in raw cotton, as before stated, may be reckoned at 11,500,000 pouds; out of this amount 8,000,000 pouds are imported over the European frontiers, to the value of 80,000,000 roubles, which sum forms approximately 22.5 per cent of the total value of the imports. But this considerable sum appears small when compared with what would be paid by the country to foreign manufacturers if, instead of raw material, finished goods were imported. In reality, if it is granted that 11.5 million pouds of cotton consumed by the Russian manufactories would approximately give 10,000,000 pouds of finished goods, further allowing

that if instead of Russian goods consumers should be supplied by those of English make at the lowest possible rate of 25 roubles per pound, then the amount of Russian money sent abroad would be 250,000,000 roubles, exceeding two and a half times the amount paid to foreigners for raw cotton. The influence of increased imports would materially affect the exchange, as will be seen by statistics given in the Introduction to this book. Moreover, the development of the cotton manufacturing industry in Russia has created a special branch of production, namely, the cultivation of cotton, with a view to obtaining the necessary material for spinning, and this branch may be said to have a splendid prospect in the future.

In Turkestan at the present time there are 375,000 dessiatines of land prepared, which are quite suitable for the planting of cotton, and capable of producing 7,000,000 pounds of fibre in the clean state. Thus in the near future probably the greater part of the Russian cotton industry will be supplied with native raw material. Consequently the protective tariff on cotton goods has undoubtedly produced visible fruits. Taking into consideration that the Russian cotton manufacturing industry grows with such amazing rapidity, and at the same time improves in the quality of its production, one must naturally suppose that in time, and probably at no very distant date, this industry will become so firmly rooted that with the smallest protective duty it will be able to freely withstand foreign rivalry.


The competition with England forms a subject for serious consideration to Russia, as well as to the majority of European countries. As regards the extent of the development of the cotton manufacturing industry, England unquestionably occupies the first place among other nations, as she possesses more than half the total number of spindles in the world, and notwithstanding the perfection at which she has arrived in the construction of machinery further improvements are constantly made, as may be seen for instance in the improvements in carding engines and ring frames, made since the Manchester Exhibition of 1887, the spindles of which move at the tremendous speed of 11,000 to 12,000 revolutions per minute. Thus, spinning in England from a technical point of view has the advantage of richer surroundings than any other country on the continent of Europe. Besides this, English cotton manufactories serve as model schools, organized by a body of experienced masters and workmen for producing new kinds of goods. The cheapness of raw cotton, the abundance of splendid and cheap coal and cast iron, the possession of one of the first cotton markets, Liverpool, all these combined factors form the ruling stability of the English cotton industry.

One of the essential causes which may retard the development of cotton manufacture in Russia is the insufficiency of works for the construction of cotton spinning machinery. This inadequacy compels Russia to use machinery of English make (Platt Brothers, Howard and Bullough, Dobson and Barlow, Curtis and Sons, Samuel Brooks, Hetherington, (Brighton, Asa Lees and others) and this circumstance presents great difficulties to the Russian spinner. The construction of machinery was first commenced in England, and up to the present, that country has retained the priority. She not only fully supplies her enormous home wants, having about 44,000,000 spindles at work, but furnishes with her product the whole of the continent of Europe.

The preparation of cotton spinning machinery belongs to a class of industry which requires for its foundation an immense amount of capital. It is palpable that

with the 6,000,000 spindles existing in Russia, it would be difficult to expect any considerable home demand for spinning machinery, at the present time, and consequently it is not to be supposed that any special works can be established for its construction. Machinery of Russian make would be very expensive at first, and the industry itself would require a considerable protective tariff to defend it from English competition, which of course would make the further development of cotton spinning very difficult. Nevertheless the fact that at the present time Russian works engaged in the construction of looms and preparatory weaving machinery have gained a firm footing, shows that little by little there will be sufficient employment found in Russia for similar works for the construction of spinning machinery, which in time will form an independent industry. The initiators of this work should be the owners of cotton spinning mills, as persons mostly interested in the progress of spinning.

By reducing the price of machinery it would be possible to obtain a cheaper product of an improved quality. The erection of a cotton spinning mill of 40,000 spindles in England costs from 12 to 15 roubles paper per spindle, whereas in Russia the erection of a similar mill would cost double that amount, namely 25 to 30 roubles per spindle. In this manner the depreciation in machinery falls considerably heavier per pound of yarn in Russia than in England, but any attempt to reduce this cost is in the highest degree injurious to the industry. Thus in order to increase the yearly production per spindle, and to distribute the cost of depreciation per spindle over a larger amount of yarn, cotton manufacturers are obliged to have recourse to night as well as day work. Night work is in the highest degree unsatisfactory in respect to quality of production and presents great difficulties to the workmen, as well as to the manufacturer. If besides this it be taken into consideration that cotton spinning machinery is being constantly improved, and that machines made ten or fifteen years ago are 10 per cent less productive than at the present time, the nature of the advantages possessed by English cotton spinning manufactories is easily understood, especially when it is remembered that they have first class works for the construction of machinery. The expense of spinning machinery is one of the chief drawbacks to the successful development of the spinning of fine counts. Owing to the small amount of fine yarn that can be produced the cost of depreciation on such yarn falls very heavily. Naturally the more a machine produces the more area there is over which to distribute the costs; consequently, the manufacture of medium counts of yarn in Russia is essential, particularly as the principal demand is for these numbers.



CHAPTER II.

Flax, Hemp and Jute Goods.

THE production of goods made from bast fibrous materials occupies the second place among the branches of Russian manufactures, that of cotton textile fabrics ranking first. This appears at first sight very strange, and it would seem, on the contrary, that the linen goods industry ought to be the more profitable branch of manufacture, as Russia possesses vast supplies of cheap linen fibre sufficient to export 10 to 11 million pounds per annum, over and above its own requirements; while in order to carry on the manufacture of cotton textile fabrics it is necessary to import as much as 9 million pounds of raw material. This apparent inconformity is, however, explained notwithstanding the fact that flax goods have many advantages over cotton in consequence of which they are in many cases deserving of preference. Flax, for instance, is much stronger than cotton on account of the straightness of its elementary fibres, gives a smoother yarn and textile fabric, and therefore flax stuffs are not so rough as cotton and are more useful in certain cases; but on the other hand it is so much cheaper to weave cotton goods that they are considerably cheaper than flax fabrics. In order to be thoroughly convinced of the correctness of the foregoing statements it is only necessary to compare the cost of making yarn of the same fineness from both flax and cotton. One pound of flax yarn, Nos. 50 to 70, costs in material (that is, combed flax) from 12.50 to 17.50 roubles, and the cost of spinning is 9 to 12.60 roubles, making in all 21.50 to 30.10 roubles, whilst a pound of cotton yarn of the same degree of fineness, that is, Nos. 18 to 25, notwithstanding that the price of raw cotton is from 2.5 to 3 times dearer, costs in material from 9.80 to 13.60 roubles, and the spinning from 2.20 to 3 roubles, making from 12 to 16.60 roubles in all. Thus, for yarn of medium fineness cotton is 55 per cent the cheaper, and for the higher numbers this difference is still more considerable. If, therefore, the manufacture of flax goods in Russia does not seem to be so developed as the manufacture of cotton goods, it is for the most part due to the smaller demand for the former class of stuffs, which are beyond the reach of the majority of the population.

The importance of this branch of manufacture and the necessity for its further development in Russia is also shown by the universal demand for enormous quantities of Russian raw material, instead of which it would naturally be much more preferable to export manufactured goods.

The manufacture of flax and hempen goods, as a branch of industry, is deserving of particular attention partly because it is a part of that primitive kind of Russian trade which is still to a great extent carried on by separate households in the cottages. The peasants of those provinces where flax and hemp are cultivated retain part of their crop for their own special requirements; they spin the yarn themselves, weave the cloth upon looms of the simplest construction, and make durable linen. In some districts they find it possible to do without almost any cotton stuffs and only use them in small quantities on account of their attractive colours and finish. This industry may, therefore, be rightly termed a popular one.

HISTORICAL SKETCH OF THE FLAX AND HEMP INDUSTRIES.

The manufacture of flax and hemp goods has for a long time occupied a very prominent place among the native industries. The ancient chronicles referring to the tenth and eleventh centuries already mention that cloth of various kinds was made from flax and hemp. These textile fabrics were not only sold in the country, but were also sent abroad, forming an important item in the export trade of Novgorod and Pskov. In the treaty charters between the inhabitants of Novgorod and the princes in the thirteenth and fourteenth centuries the flax trade is particularly mentioned, and a special duty was levied on each bale of hemp.

When the trade route through the White Sea was discovered by the English in the sixteenth century they founded the first flax spinning works at Kholmogory and also two factories for rope-making, one at Kholmogory and the other at Vologda, as this trade had up to that time been but little developed. At the end of the seventeenth century the direction of the export trade was again changed, and Riga, Reval and Dorpat became the chief points, and Germany the principal consumer. Although Russian cloth and linen, as well as carded flax, stripped hemp and ropes, found a ready sale abroad, still these textile fabrics were of a coarser kind and the Russian gentry of that period used to order their linen abroad.

The Government had endeavoured at a still earlier period to take the flax trade under its exclusive jurisdiction, but it was only during the reign of Peter the Great that it met with the energetic intervention of the authorities, who regulated the industry itself and introduced measures for its improvement and development. Among other things an order was issued to manufacture only wide linen and to use special contrivances for making it. Furthermore, in order to facilitate the extension of linen factories Peter the Great granted all possible privileges and exemptions to the first manufacturers, such as free grants of land and buildings, special privileges in law and service, and also forbid the import of foreign linen. The first linen factories were established in the district of Moscow and the province of Yaroslav, where spinning had for a long time been the staple trade of the inhabitants.

The formation of the fleet was the means of establishing sailcloth factories in the province of Kalouga, and greatly tended to the development of the rope-making industry. Both of these latter branches of trade were under the special control of the Admiralty. Besides this, measures were taken to regulate the hemp trade and it was directed to foster it in the same way as that of flax. The same practice was adhered to in the subsequent reigns, and in addition to this, as in the time of Peter the Great, the Government preferred handing over the working of the Government factories to private firms.

Although the number of mills increased from 54 to 70 between 1761 and 1776, and although the Government showed continual solicitude, still the quality of the linen goods manufactured during the last century was not by any means all that could be desired, and even during the latter half of the last century the linen was sent abroad to be bleached. The export of textile fabrics, however, increased gradually, and in proportion to the export of flax fibre and tow, thus in 1758 to 1760, 66,000 pieces of sailcloth, Flemish linen and raven's duck were exported, and other kinds to the value of 395,000 roubles; in 1790 to 1792 the export rose to 179,000 pieces of sailcloth, Flemish linen and raven's duck, and 596,000 roubles worth of other kinds. The number of ropewalks was for a long time very limited and only began to increase rapidly during the reign of Catherine II, when there were 60 in all, the original number being 25, and the export between the periods of 1758 to 1760, and 1790 to 1792 rose from 24,000 to 104,000 pounds.

At the beginning of the present century there was a greatly increased demand for linen for the army, and this had a favourable influence upon the development of the linen trade. From 1804 to 1809 the output of the mills increased from 12,369,600 arshines with 23,711 hands, to 22,375,800 arshines with 36,500 hands. Besides satisfying the increased demands for home consumption a considerable quantity was exported.

Putting aside the first small ventures in flax spinning by machinery, the oldest, and at the same time one of the best Russian mills, is the Girardovsk factory, which was established in 1830, built according to the plans of the inventor of flax-spinning machinery, Philip de Girard, at the expense of the Charles Scholtz Joint Stock Co., in Marimont near Warsaw, whence it was removed during the Polish insurrection to its present place at Girardo. Although this mill was under the management of Philip de Girard it did not work satisfactorily when first started, owing to a series of unfavourable circumstances; the machines, for instance, which were all constructed in this country, as it was at that time forbidden to import English flax-spinning machinery, did not quite answer the purpose; there was also not much demand for finespun yarn and the cost of spinning it was high. About this time also the linen industry in England had reached a very high degree of efficiency, and was holding the monopoly of making flax-spinning machinery, and having had recourse to protective tariff, was arduously engaged in perfecting the industry. Besides the fine textile fabrics the manufacture of the coarser kinds also greatly increased there, and little by little the English goods, followed by the German, began to supplant Russian manufactures on the foreign market. The brilliant success achieved by the cotton trade was added to this, and cotton goods rapidly found favour with the Russian people, completely replacing the linen fabrics which had been up to that

time exclusively used. The results of all these unfavourable conditions for the linen trade were, an increased export of flax fibre, which attained 50 per cent between 1840 and 1850, and a gradual decrease in the amount of manufactured goods.

The attention of the Government was drawn to the difficult situation of the linen trade, and from 1837 to 1853, a great many measures were taken for relieving it. Thus in 1837, model flax cultivation was established; in 1845 all those who were desirous of studying flax spinning and weaving by machinery were allowed free access to the Alexandrovsk mill. Finally, in 1844 to 1846 a special commission investigated the condition of the linen trade in Russian and abroad, which resulted in more attention being given in the agricultural schools to the teaching of more rational methods of cultivating and of dressing flax, in providing the peasants with metal strickles for carding, spinning wheels and metal reeds, and various kinds of rewards were promised to the first organizers of flax spinneries and factories for making high class linen goods. These measures, and especially the latter, were the means of starting, soon after 1850, several establishments for weaving, bleaching and dressing linen by machinery; but unfortunately the customhouse duties were changed in 1850, and the duty on all linen goods considerably lowered; this brought an enormous influx of foreign goods into the market, attaining the value of 1,000,904 roubles in 1851 to 1853, so that the new mill owners found themselves in a very critical situation, which in many cases ended in complete liquidation.

The hemp-spinning and rope-making industries did not cease to increase during the first half of the present century, although they were subjected to certain variations, so that instead of the sixty factories with an output of 252,000 pounds of rope and yarn in 1804, there were already in 1850 as many as 160, producing 1,177,000 pounds. The export of hempen goods also increased proportionately: thus, from 1824 to 1828 and from 1851 to 1853 the mean yearly export rose from 257,000 to 448,000 pounds.

Owing to the increased consumption of linen for the army during the Crimean war business was not only brisker for those mills which had survived the crisis, but several other flax spinning works were started, first in the province of Kostroma and then in other districts. These new mills prospered well at first, especially as the price of the raw material had fallen to 1.30 roubles per pound. After the termination of the war, however, it became difficult to find a market for the yarn and the large consumption of flax fibre had so raised the price of the raw material during the winter of 1861 and 1862, to 4.50 roubles per pound, that the position of flax spinners thus again experienced a change for the worse. Obligated to find a sale of some sort for their goods the manufacturers began to supply the peasants with yarn on credit. This circumstance had also an important bearing upon the development of the linen trade amongst the cottagers of the provinces of Kostroma and Yaroslav; they entirely gave up hand spinning and took to weaving, bleaching and dressing linen. The cotton crisis, which occurred soon after 1860, not only released the Russian factories from their inaction but was even the means of establishing new flax spinning works.

In general, during the twenty-five years succeeding the Crimean war, the development of the flax-spinning trade far surpassed that of linen. In 1856

the value of both these branches was 2,871,000 roubles, out of which about 500,000 roubles represent the share of the flax spinning; whilst in 1879 it rose to 13,100,000 roubles, and the linen industry only increased to 11,230,000 roubles, that is to say, that flax-spinning by machinery preponderates. This is due to the fact that, besides the linen factories, the village weavers after 1860 also adopted machine-made yarn. In any case the figures which have been quoted show that the development of the linen manufacture for the given period was by no means inconsiderable. In 1856 large linen factories, producing 300 thousand to 500 thousand roubles worth of goods, were exceptional; in 1879 there were several which turned out more than a million roubles worth. However, as the production increased the total number of mills decreased, the large factories supplanting the smaller ones.

The Russian linen goods also greatly improved in quality, as shown by the Industrial Exhibition of 1870. although most of the mills manufactured the lowest and medium numbers of yarn, up to № 40, yet many spun Nos. 50 to 80, and two mills even made № 160, namely those of Gribanov and Hill & Ditrich. Besides this, it was shown that considerable progress had been made in dressing linen and chlorine bleaching was widely diffused. These improvements were important, because after the Crimean war a new kind of sackcloth and packing cloth, manufactured from jute, made its appearance on the foreign markets, and due to its cheapness soon took the place of the linen and hempen goods previously used for that purpose, so that the demand for the rough kinds of linen and hempen cloth still further decreased.

By examining the exports of hempen yarn, ropes and string from 1855 to 1888, as representing the most reliable data for judging the degree of development of the hemp trade during that space of time, it may be concluded that the export of hempen goods increased all the time up to 1870, but thereafter began to fall off, but only as regards the export of rope, as that of hempen yarn continued to increase.

This historical sketch terminates prior to 1880 and the condition of the trade in flax, hemp and jute goods during the last fifteen years may now be investigated.

THE QUANTITY OF MATERIAL USED AND ITS PROPERTIES.

The flax crop of the Russian Empire is on the average 17,500,000 pounds; during a good harvest, it reaches 20 million and during a bad harvest declines to 15 million pounds, that is, about 56 per cent of the total amount cultivated on the earth's surface. After subtracting from this the quantity sent abroad, which from 1887 to 1891 averaged about 10,900,000 pounds per annum, the amount used within the limits of the Russian Empire will be found to be 6,600,000 pounds, of which about 1,800,000 pounds go to the spinning works, the remainder being used by the village workmen, although at present the latter prefer to make linen from machine-spun yarn.

The quantity of hemp produced in European Russia may be taken as 8,500,000 pounds, or about 40 per cent of the whole amount gathered in Europe. Subtracting the quan-

tity sent abroad, which between 1887 and 1891 averaged about 3,600,000 pounds per annum, the amount used in Russia is therefore 4,900,000 pounds, of which about 2,500,000 pounds are consumed by various factories and mills, the remainder being used in the numerous hemp-stripping establishments, or else in the village industries.

The superior qualities of the Russian flax, which is successfully cultivated over a wide area of the Russian Empire, enable it to furnish most excellent fibre, quite capable of being spun into fine yarn, as was confirmed by the work of Gribanov, and Hill & Dietrich, where before 1870 they used already in some cases to spin № 160. It may be mentioned that the numbers of flax yarn are determined by the number of skeins in a pound (36 pounds) divided by three, the length of a skein being 3,600 yards. In Russia, unfortunately the work of flax culture is not subdivided in the same way as abroad, and the peasants who are the principal cultivators, as land-owners sow comparatively little flax, have also to do all the work of parting the fibre from the stalk. If then these peasant flax farmers, on account of their small store of agricultural knowledge, experience great difficulty in forsaking the primitive methods of flax culture, it is still more difficult for them to improve in any way their old-fashioned means of flax dressing, which is a separate occupation from their ordinary agricultural duties. Thus the most usual way of dampening the flax, by allowing it to lie in the dew, or by spreading it about the fields, is less rational than steeping it in water; this spreading is also generally done in cold, unfavourable autumn weather: and the breaking and stripping are very often effected with very inefficient appliances, after which it is found necessary to powerfully dry the flax straw in kilns, undoubtedly injuring the quality of the fibre.

The unsatisfactory nature of the flax dressing and sorting has drawn upon itself the attention of the Agricultural and Farming Department, and experienced instructors were first prepared and then a whole series of measures were pointed out for placing the flax trade on a more rational footing. One of the most important of these was the establishment of the first flax station as a practical school for flax culture. Notwithstanding the short career of these first instructors, the successful manner in which they applied new and improved methods not only again drew public attention towards this deeply rooted branch of Russian farming, but had also the practical result of leading to the establishment of large flax farms. These first experiments proved that by improving the method of treating flax straw alone, the value of the fibre rose 50 per cent, and at the same time increased the output by 75 per cent. The quality of the fibre was so good that it was used for spinning yarn of those numbers which had previously been made of Belgian flax, and it was sold at 10 to 11 roubles per pound. These results are good omens for the further success of the Russian flax trade.

Although there is a great difference in the fibre of the various kinds of Russian flax in the market, they may yet be divided into two distinct groups: *steeped flax*, being those kinds which are prepared by soaking in water, the fibre being much stronger, longer and more uniform; *spread flax*, which is moistened only with dew and is known by its softness and greasiness. Each of these two groups may be divided into three classes according to the quantity of combed flax and combings obtained and also as regards their spinning properties:

DENOMINATION.	Combed flax.		Combings.		Loss per cent.
	Useful per cent.	Mean №.	Useful per cent.	Mean №.	
Steeped flax:					
1st class	50	50	45	25	5
2nd class.	42	40	53	20	6
3rd class.	35	35	59	18	6
Spread flax:					
1st class	40	35	54	18	6
2nd class.	25	30	68	14	7
3rd class.	18	20	75	10	8

The best known steeped flax comes from the government of Pskov; it really belongs to the 2nd class, but then the quantity of the 1st class steeped flax is in general very small. The best qualities of spread flax come from Vologda and are used for spinning Nos. 140 to 160 yarn. These high class qualities are for the most part used in the Russian factories. On the average the Pskov flax yields after combing 42 per cent suitable for spinning Nos. 30 to 50 yarn, and 52 per cent of combings for Nos. 10 to 18; the Vologda flax yields 46 per cent of combed flax suitable for Nos. 50 to 80, and 50 per cent of combings for Nos. 14 to 24.

Besides stripped flax a considerable quantity of tow is made by intentionally working flax into combings by means of very primitive kinds of hackles. The Siberian and Crimean tow are the most highly prized and are often not inferior to good quality stripped flax. In 1889 the price of all kinds of tow was only 10 per cent below that of stripped flax. The best kind of hemp for spinning yarn comes from the government of Smolensk; it is remarkable for its fineness, strength and silkiness of fibre; the most suitable for rope-making comes from the government of Orlov.

THE IMPORT OF FOREIGN GOODS INTO RUSSIA.

The import of yarn, rope and other cordage from 1877 to 1891 is given in the following table:

YEARS.	Y a r n.		Rope, string, nets.	
	Pounds.	Roubles.	Pounds.	Roubles.
POUNDS AND ROUBLES IN THOUSANDS.				
1877	10	351	31	201
1878	16	436	79	556
1879	16	489	83	463
1880	17	434	26	144
1881	15	464	20	88
Average	14.8	434.8	47.8	290.4
1882	—	—	13	88
1883	8	240	13	64
1884	11	330	17	103
1885	7.3	235	15	90
1886	5.9	176	10	159
Average.	8	245.2	13.6	100.8
1887	8.4	241	12	77
1888	7.6	245	13	84
1889	3.5	97	25	139
1890	4.7	118	13	77
1891	4	115	13	72
Average.	5.6	163.2	15.2	89.8

The import of yarn, as shown in the table, is quite insignificant. The abrupt cessation of the import in 1883 is explained by the classing of sewing thread and fine string under a different head in the customhouse tariff. In any case the import during the last five years is 30 per cent lower than that from 1883 to 1886. At present only high numbers of flax yarn are imported which, owing to the unsuitability of the Russian yarn, are not made at all, or else in very small quantities by the Russian manufacturers. There is no import whatever of hempen or jute yarn. Two kinds of flax yarn are mostly imported, namely good warp from № 90 to № 130, and cheap weft, principally boiled, as after boiling the yarn loses 20 per cent of its weight.

The chief kinds of rope and cordage imported are manilla hemp and New Zealand flax ropes, and cord made of yarn above Nos. 8 to 10, manufactured from Italian or German hemp, and finally, fishing nets to the amount of a few tons. In any case the quantity and value, not only of the last-named goods but of all kinds of cordage, are very insignificant when compared with the home production of 900,000 pounds valued at 5,400,000 roubles from 1887 to 1889. The same conclusion may be arrived at by consulting the following table:

YEARS.	LINEN AND HEMP FABRICS.		JUTE AND LINEN SACKS AND JUTE PACKING CLOTH.	
	Pouids.	Roubles.	Pouids.	Roubles.
POUIDS AND ROUBLES IN THOUSANDS.				
1877.	70.4	1,191	564	3,531
1878.	140.2	2,327	771	5,741
1879.	146.9	2,566	711	4,277
1880.	143.0	2,494	740	4,341
1881.	101.7	1,756	520	3,426
Average	120.4	2,066.8	661.2	4,263.2
1882.	—	—	229	1,233
1883.	14.1	1,065	180.8	1,466
1884.	17.3	1,361	242.2	1,957
1885.	17.2	1,350	323	2,430
1886.	15.1	1,098	308.8	2,467
Average	15.9	1,218.5	256.8	1,910.6
1887.	15.8	995	151.8	892
1888.	7.0	616	168.7	783
1889.	8.3	758	117.8	583
1890.	10.0	751	56	285
1891.	6.5	701	17	127
Average	9.5	762.4	102.3	534

The first paragraph contains very different sorts of textile fabrics, such as linens, batist, table linen, handkerchiefs, towels, stuffs for upholstering, mattresses and carpets, either of flax, hemp and jute, or mixed with cotton, and also dyed, printed and woven in colours, and some knitted and plaited goods. The mean yearly import during the period from 1883 to 1886 was 13.3 per cent of that of the period from 1877 to 1882, and during the next five years it was 58.8 per cent of that from 1882 to 1886. On comparing the mean values another result is obtained, and the corresponding decrease is expressed by the per cents 58.8 and 62.5 respectively. This clearly demonstrates that lately only very high class goods have been imported, which could only have been manufactured at home from imported flax or yarn and from various twilled and flowered stuffs and the like, and sold as fashionable and expensive articles to the wealthier classes of society.

During the second half of the present century coarse jute goods, especially sacks, were much sold on the European markets, and afterwards appeared here. This had the effect of decreasing the demand for the corresponding linen and hempen goods and led to a brisk import of jute sacks and packing cloth: for this reason the gen-

eral import during the period from 1877 to 1881 was very considerable, namely, 661,000 pounds, with a total value of 4,264,000 roubles. In Begetzk, in the government of Tver in 1870, as many as 2,500,000 linen sacks were made, being always in great demand for the wheat trade; in 1879 only 900,000 were turned out, and in 1880 the amount further decreased to 500,000 pieces.

When the customhouse duties were raised in 1881 the quantity of sacks imported began to decrease, although not without some fluctuations: from 1882 to 1886 the import fell to 38.5 per cent of that of the previous five years, and during the next five years still further diminished 40 per cent, so that the mean yearly import during 1887 to 1891 was only 15.5 per cent of that from 1877 to 1881. The value of the import during that decade decreased still more, namely to 12.5 per cent. It must be observed that as the import of jute sacks declined, the export of raw jute began to increase; that is to say, the home production of jute began to develop. From 1887 to 1891 the mean yearly export was 513 thousand pounds. Taking the average waste in manufacturing jute goods as 15 per cent, the average yearly output of the jute factories would be equal to about 436,000 pounds, which is 4.3 times more than the mean yearly import of all the above mentioned goods during the last five years.

Thus the general value of the yearly import through the European frontier of all the goods enumerated from 1888 to 1891 was, on the average, 1,551,000 roubles, which is about 5.5 per cent of the total production of the Russian flax-spinning linen cloth mills, and ropewalks; this was abundantly covered by the export of similar goods from Russia, as may be seen from the following table:

YEARS.	Yarn.		Textile fabrics.		Rope and cord.		Various goods.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
POUNDS AND PAPER ROUBLES IN THOUSANDS.								
1884	141	1,245	—	530	246	1,154	1.9	74
1885	116	611	37.8	418	248	1,009	9.7	44
1886	117	494	35.8	461	198	1,104	18.4	125
1887	145	764	35.7	474	203	1,104	8.3	69
Average. . .	130	778	—	470	224	1,070	11.4	78
1888	102	463	46.1	706	194	1,170	8.8	911
1889	168	784	49.2	915	234	1,515	17.3	217
1890	140	560	24.7	397	204	1,250	6.7	45
1891	131	—	24.9	—	268	—	11.0	64
Average. . .	135	—	36.2	—	225	—	10.9	111

The Russian export consists almost entirely of hemp yarn, and only a few hundred pounds of flax yarn. Concerning the textile fabrics it is found that the prin-

cial demand is for coarse linen; the export of sailcloth, flenish linen and raven's duck, which about 1830 amounted to nearly 50,000 pounds, has now declined to less than 6,000 pounds. Although the export in all classes of goods has decreased during the last fifteen years, this principally refers to yarn and textile fabrics, which have been thrust out of the foreign markets by the cheaper jute goods; at present the total value of rope and cord exported exceeds a million, and in some years has attained 1,500,000 roubles. At all events during the two periods of four years extending from 1884 to 1891 the mean yearly export was constant in quantity but rather increased in value for the latter years. It may be observed that the Russian export trade with Asia has developed gradually since 1880, and at present linen and hempen goods are exported to that part of the world to the value of 500,000 roubles per annum.

The following figures compiled from the statistics of the Department of Trade and Manufactures show the yearly returns of the flax-spinning and linen trades from 1885 to 1889:

	PAPER ROUBLES IN THOUSANDS.	
	Flax spinning.	Linen trade.
In 1885.	14,567	11,247
» 1886.	13,467	10,848
» 1887.	14,287	12,766
» 1888.	15,164	15,052
» 1889.	14,314	15,613
Average.	14,360	13,105

A clearer view may be taken by examining the year 1889 in detail. The total amount of yarn manufactured was 1,600,000 pounds; by subtracting from the returns of the year 2,000,000 roubles which represent the textile fabrics, it will be found that with a production of 1,130,000 pounds of yarn at the average price of 11 roubles a pound, the returns of the flax spinning mills was about 17,600,000 roubles. Granting that nine-tenths of the yarn is woven into stuffs and that the cost of the yarn is about three-fourths of that of the textile fabrics, it will be found that the returns for the whole of the linen trade for 1889 was fully 21,100,000 roubles. It must be observed that the figures given by the Department of Trade and Manufactures, and the calculations just mentioned, include the returns of jute production which has of late years averaged 436,000 pounds, worth 8 roubles per pound, making a total of 3,500,000 roubles.

The value of the rope and cord manufacture in Russia during 1880 was 7,000,000 roubles; from 1881 to 1884 it averaged from 6,200,000 to 6,500,000 roubles and from 1885 to 1889 it may be represented by the following figures:

1885	4,487,000	paper roubles.
1886	3,280,000	» »
1887	5,049,000	» »
1888	4,983,000	» »
1889	5,690,000	» »
Average	4,698,000	» »

Upon adding the production of the Polish and Siberian mills, which during this period averaged 188,000 pounds, the total production of the rope trade attains 4,886,000 roubles. The table shows that the decrease in 1886 was of a transitory character, and in 1889 the returns again amount to almost 6,000,000 roubles, so that at present they may be taken as 5,000,000 to 5,500,000 roubles.

THE TECHNICAL RESOURCES OF THE TRADE.

According to the statistics of 1889 there are 245,588 flax spindles in Russia, and most factories work night and day. Supposing that half the mills work during the whole twenty-four hours and the other half, twelve hours per diem, and that there are 280 working days during the year, and again that the above-mentioned spindles were working according to the foreign practice, that is, 300 days of ten hours per year, it would be found that under the latter conditions 412,588 spindles would be required to do the same amount of work produced by the Russian plant under its own conditions.

In 1889 there were 7,312 power looms in the Russian factories. Working 300 days of ten hours, 12,284 looms would be required to do the same work, this number exceeding that of Germany, which occupies the third place in this industry in Europe. In the same year there were thirty-one flax spinning mills in Russia in Europe, some of them with sections for weaving; these mills employed 20,278 hands. There were also 74 linen factories with 23,757 hands, making a total of 105 mills employing 44,035 hands. There are numerous ropewalks, sailcloth, sack and hemp-spinning factories, but unfortunately the want of official data renders it impossible to give a detailed account of their number and production. In general there were in 1888 in Russia and Siberia 263 ropewalks and sack factories, producing 1,281,000 pounds of rope and cord and employing 6,460 hands. This, however, does not convey an accurate conception of the Russian hemp industry, as besides the factories, it is to a great extent carried on in the villages where it is almost impossible to collect reliable information.

A comparison between the Russian and foreign trades, with reference to the amount of raw material consumed in manufacture and the technical aspect of each, will be of interest. The following table shows the quantity of hemp fibre produced and required in the first class European countries from 1884 to 1888:

	Crop of fibre.	Consumption.
Russia.	17,500,000 pounds	6,248,000 pounds
Germany	4,041,000 »	5,646,000 »
Austro-Hungary	2,773,000 »	4,175,000 »
France.	2,225,000 »	5,790,000 »
Great Britain	1,312,000 »	5,961,000 »
Belgium	1,202,000 »	2,057,000 »
Italy	1,095,000 »	1,091,000 »

Thus Russia consumes slightly more than one-third of its total amount of fibre and ships by far the greater quantity of it abroad, whilst in the other countries the consumption considerably exceeds the crop, except in Italy where it is almost equal to it; England consumes 4.5 times more than it produces, Austro-Hungary 2.6 times, Belgium 1.7, France 1.5, and Germany 1.4 times.

Upon comparing the relative numbers of flax spindles and power looms in the various European countries, the following results are obtained:

	SPINDLES.	LOOMS.
Great Britain	1,168,793	52,187
Russia	412,588	12,284
France	400,000	18,821
Austro-Hungary	328,053	—
Belgium.	307,940	4,755
Germany	270,000	11,000
Italy	43,000	772
Other countries	31,746	2,676
Total.	2,962,120	102,495

The number of spindles and looms in Russia, shown in the above table, have been calculated to a working year of 3,000 hours, and is only exceeded by Great Britain with reference to the number of spindles, and occupies the third place according to the number of power looms.

The next table gives the hemp crop and the consumption in the same countries taken from statistics during the period of 1884 to 1888:

	CROP.	CONSUMPTION.
	P o u n d s.	
Russia	8,500,000	5,039,000
Italy	4,500,000	3,547,000
Austro-Hungary	4,270,000	4,403,000
France	2,500,000	3,522,000
Germany	850,000	2,290,000
Belgium.	60,000	428,000
Great Britain	—	3,289,000

Thus in only two countries is the consumption less than the crop produced, and the Russian factories consume only a little more than half the crop. In Austro-

Hungary the production and consumption are about equal: Great Britain grows no hemp; in France the ratio is 1 to 4, in Germany 2 to 7, and in Belgium, 7 to 1, respectively, between the crop and the consumption.

As regards quality, it may be observed that the continuous decrease in the small amount of imported goods of this branch of manufacture is a proof of improvement in the quality of the Russian flax and hempen goods, and also of the satisfactory progress of manufacture of jute textile fabrics, lately started here. The flax spinners and linen manufacturers, stimulated by the increasing demand for cotton goods and the rapid success of the jute trade, have laboured to improve the quality and excellence of their wares.

At present, besides the Zhirardovsk mill, of Hill and Ditrich, which has long been famed for the variety and excellence of its goods, such as yarn as fine as № 160, and that of Gribanov, who has been spinning fine yarn, № 140 to № 160 for many years and making high class linen from the excellent Vologda fibre in the vicinity, there are many other mills spinning Nos. 50 to 60, and even small quantities of № 70 from the highest quality of Russian raw material, and Nos. 100 to 120 from imported Belgian flax. The combings and tow are used for warp, Nos. 4 to 25, and weft Nos. 6 to 22, and the combed flax for warp, Nos. 3 to 90, and weft Nos. 24 to 70. The difficulty of weaving fine yarn not only consists in the using of high class imported flax, but the cost of manufacturing it in Russia is very high as the spinning jennies for fine yarn are not productive, and therefore their amortization is very expensive; furthermore, as there are no works in Russia for making spinning machinery it has to be ordered abroad, thus consequently greatly increasing the price of the yarn.

Besides the usual old-fashioned unbleached, half-bleached and bleached kinds of coarse stuffs, such as sailcloth, tarpaulin, lining, canvas, raven's duck, shirting from $\frac{1}{4}$ to $\frac{6}{4}$ arshines wide, Flemish linen $\frac{1}{4}$ to $\frac{12}{4}$ arshines wide, sacking, and ticking made of Nos. 6 to 20 yarn in large quantities, the Russian mills turn out from Nos. 20 to 70 a variety of medium fine narrow linen $\frac{1}{4}$ to $\frac{5}{4}$ arshines wide, and sheeting $\frac{3}{4}$ to $\frac{16}{4}$ arshines wide, generally sold ready bleached. The finer qualities, such as linen, batist, handkerchiefs, are made partly of local and partly of imported yarn, and in comparatively small quantities, and usually when specially ordered. The medium fine goods leave nothing to be desired at present, either in weaving, bleaching or dressing. As has been already said, the manufacture of low class and medium linen is, besides the great expense of weaving fine yarn, stimulated to compete, at all events within certain limits, with cotton goods, and cheap good linen still finds a ready sale with the middle and lower classes. The manufacture of damask table linen, a most difficult branch of the trade and therefore only open to the best mills, is also making constant progress, and at present many of the factories are making tablecloths and napkins both unbleached and bleached and with coloured borders, or half-linen in colours or with a coloured silk weft in various distinct designs.

The manufacture of hemp goods is undoubtedly also improving. Besides ropes, cord, string, fishing nets, sacking and sailcloth, hemp mattresses, covers, fire hose, belting, tablecloths, napkins, stuffs for covering furniture and for making curtains, are also manufactured.

The jute manufacture is mostly limited to sackcloth, but it also includes plain and coloured stair carpets, mats, furniture stuffs and other goods.

COST OF MANUFACTURE.

The first quality, pure flax yarn, is sold at 60 to 50 kopecks per pound-number, weft Nos. 20 to 100, and 65 to 55 kopecks per pound-number, same numbers warp. Second quality, combed yarn, Nos. 18 to 14, is quoted at 11 to 9.50 roubles per pound, with a difference of 75 kopecks for every two units in the number. Nos. 12 and 10 cost 8.50 and 9 roubles, respectively, per pound; and lastly Nos. 4 to 8 are sold at 5.50 to 7.50 per pound, with a difference of 1 rouble per pound-unit of number. The prices given refer to raw yarn as it usually comes into the linen factories.

The cost of manufacturing flax yarn is as follows: cost of combed flax suitable for Nos. 20 to 70 yarn is about 25 kopecks per pound-number; the combings used for yarn Nos. 4 to 18 cost 44 to 26 kopecks per pound-number; the spinning of combed flax averages 18 kopecks per pound-number. The spinning-cost of the combings is determined by the formula:

$0.16 N + (1.2 \text{ to } 1.5)$, which gives the price of one pound of yarn in roubles. The cost of spinning jute yarn Nos. 4 to 6 is about 2 roubles per pound.

The mean price of first class Russian linen varies from 25 to 65 kopecks per arshine, 1 arshine being equal to 28 inches. The following table shows the cost of manufacture per arshine of linen $\frac{5}{4}$ arshine wide, from boiled yarn:

Sorts of linen.	Nos. of yarn.	Cost of yarn in kopecks.	Cost of weav- ing and bleaching in kopecks.	TOTAL COST IN KOPECKS.
N ^o 1	20/24	16.50	6.19	22.69
» 2	24/30	18.00	6.53	24.53
» 3	26/30	19.50	6.86	26.36
» 4	30/36	21.48	7.31	28.79
» 5	34/40	23.28	7.72	31.00
» 6	40/50	25.76	8.26	34.02
» 7	46/56	27.80	8.72	36.52
» 8	50/60	29.10	9.08	38.18
» 9	56/70	31.72	9.60	41.32
» 10	60/70	33.16	9.92	43.08

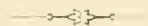
The expense of the weaving and bleaching approximately amounts only to one-fourth of the cost of the finished goods, or about one-third of that of the yarn.

CONCLUSION.

A knowledge of the present condition of the manufacture of goods from fast vegetable fibres leads to the inevitable conclusion that this branch of trade is thoroughly developed, and fully capable of satisfying the internal demands, Russia is

quite able to compete with the foreign manufacturers of linen of medium fineness, which finds in general a most ready sale. The import of foreign goods is limited to an inconsiderable quantity of specially fine wares. Although the manufacture of this latter class of goods is also making progress of late years in Russia, thanks especially to the good results of the initiative and cooperation of the Agricultural and Farming Department in cultivating high class fine fibres, still in reality this import does not materially injure the interests of the Russian trade, because there is such a limited demand for such goods that it would not be very advantageous to manufacture them at home. The raw material being for the greater part suitable for textile fabrics of medium fineness, it is best for the Russian mills to keep to that quality which can be made cheaper than in any other country, and as the universal demand for them is enormous the sale of Russian goods has every chance of increasing abroad.

The manufacture of hempen and jute goods continues to keep pace with the increasing demand for them, and in any case the supply is at present quite equal to the internal demand.



CHAPTER III.

Woollen goods.

OWING to the severe climatic conditions of Russia, where in many parts warm clothing must be worn during eight or nine months of the year, woollen goods are an absolute necessity. Coarse woollen tissues for supplying the wants of the poorer classes of inhabitants, have for years been made by hand, in the homes of the peasants. Consequently sheep form a necessary part of the belongings of the poorest peasants, as much so as a horse, a cow, or any other domestic animal. At the present time in many governments the peasant classes use goods fabricated by themselves. They make hand-spun yarn, which is woven into coarse grey cloth for clothing purposes, on looms of the simplest construction. Besides this, wool is used in the peasant household for making felt, felt boots and gloves.

Comparatively speaking, it is not long since such an industry of coarse woollen goods was universally spread throughout the villages, but with the lapse of time and the spread of cheap woollen goods manufactured in mills, this trade gradually sank, and in many parts there remain only the manufacture and rolling of felt boots. The making of cloth and other woollen goods is at the present time sufficiently developed, both as to quantity and quality. The Russian woollen industry, besides clothing the army, fully satisfies the home demand for goods of low and medium quality. Imported textures are principally fine cloths, and fashionable fancy goods.

HISTORICAL REVIEW OF THE INDUSTRY.

The foundation of the manufacture of woollen goods in Russia was laid in the last century, during the reign of Peter the Great. These goods were first manufactured solely to clothe the army, in consequence of which manufacturers had special privileges and patents granted to them. In the year of 1712 an order was issued that the army should be clothed only with textures of Russian make. Peter the Great, considering the development of the woollen industry in Russia of

great importance, interested himself in the improvement of sheep farming, procuring from abroad experienced sheep farmers, and also did much to facilitate improvements in the manufacture of cloth from a technical point of view. Having founded Government mills, he let them to experienced parties on advantageous terms, at the same time binding the tenants to teach free of charge all those who were desirous of learning the trade. Notwithstanding many privileges and encouragements on the part of the Government, the woollen manufacture developed very slowly, and at the end of the last century the output was very small.

From the beginning of the present century the industry commenced to develop more rapidly, both in respect to quality and quantity, although at first the production sufficed solely for the wants of the Government and for the clothing of the army. In the year 1822 the woollen mills for the first time fulfilled the purpose the Government had in view in founding these establishments, as the production then reached about 4,000,000 arshines, which quantity exceeded the requirements of the Government. The remarkable increase in the woollen manufactures at this time should be attributed principally to the springing up of the Polish industry.

The government, desirous of developing this manufacture in the Vistula regions, invited woollen merchants, manufacturers and artisans from abroad, giving them various advantages, means of immigration, freedom from taxation, free use of land and forests. The small village, Lodz, situated on the river Lodka and surrounded by small woods, which guaranteed a supply of building material and fuel for a long period, was considered suitable for the construction of fulling mills, and was fixed upon as a settlement for woollen manufacturers, from Saxony and Prussia. The small German manufacturing colony thus formed in Lodz was changed in a short time, through the constant influx of the foreign manufacturing element, into a large village devoted principally to the production of woollen goods.

In 1830 the number of woollen mills in Russia was 390, with 67,000 work-people, and a production of 7,700,000 arshines of cloth. The events of 1830 compelled many of the masters to remove from the Polish to the Russian mills, which from a technical point of view greatly facilitated the development of the industry in many other parts of the Empire. Another branch of the industry made its appearance about this time, namely, the making of smooth, napless cloth. When first this manufacture was introduced it was made solely from imported yarn and continued to be so fabricated until woollen spinning mills were erected at home.

Commencing from the third decade, both branches of the woollen industry gradually developed and in the fifth decade assumed considerable dimensions; thus, during the time of the Crimean campaign in 1856, woollen mills could easily supply 13,000,000 arshines for the clothing of the army.

The further progress made in the manufacture of woollen goods is shown in the following diagram. Fig. 1, the value of yearly output being collected from official statistics: A, total production of woollen goods; B, manufacture of cloths; C, manufacture of napless woollen, and half-woollen goods; and also in diagrams showing the importation of foreign goods, Fig. 2; D, the importation of yarns; E, the import of goods, unknitted and woven. On examining these diagrams, the unceasing and gradual growth of both branches of the woollen industry up to the seventh decade must be remarked; attention must also be given to the proportionate de-

FIG. 1.

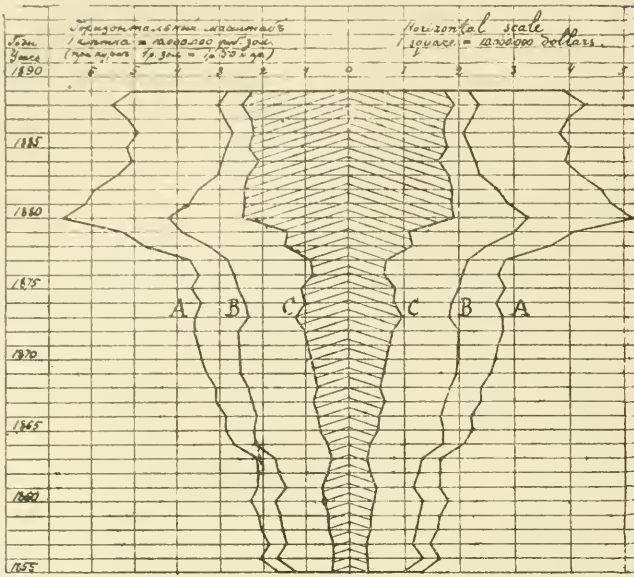


Fig. 1. Diagram of annual output: A, total production; B, manufacture of woolen cloths; C, napless cloths; on the left, in tens of millions of roubles gold; on the right, in tens of millions of dollars.

FIG. 2.

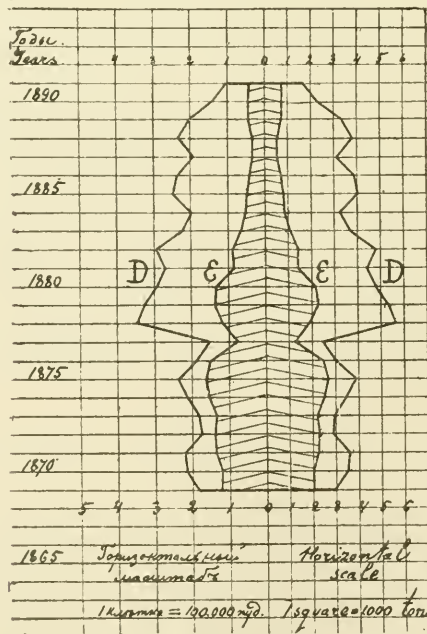


Fig. 2. Diagram of imports over European frontiers: D, yarn; E, goods; on the left, in hundreds of thousands of pounds; on the right, in thousands of tons.

velopment of both these branches. After the temporary bad trade from 1875 to 1877, there was a general revival of Russian industry and trade at the termination of the Russo-Turkish war, and woollen mills began to work with unusual energy, but after that time, commencing from the year 1880, the woollen manufacture began to curtail its production, and from 1884 to 1886 was in a critical state.

An especial falling off was observed, in the manufacture of woollen textures, but at the same time the production of napless cloths suffered in a considerably less degree. This crisis in trade was caused by the mills increasing their production disproportionately to the demand. There was a surplus of manufactured goods, and these goods, not finding a sale, were thrown on the hands of the manufacturers, which caused a temporary stoppage of work in the mills.

In the eighth decade there were bad crops, even in the best growing districts, and this had great influence in reducing the consumption. During this time the Polish regions suffered, especially Lodz, Zgiersch, Tomashov and Pabianitsa. The manufacture of woollen goods developed considerably in this district during the years 1870 to 1880, the output having increased more than five times. Such a development in production, which was not in proportion to the demand and exceeded the requirements of the most favourable years, called forth a reckless competition between the manufacturers, and had an effect on the quality of manufactured goods, cheapness of production being the principal aim, and consequently goods of Polish fabrication lost the reputation they once held. Owing to this departure a considerable amount of shoddy, many times exceeding the quantity made in the whole of the Empire, began to be manufactured in the Polish districts. Small spinning mills prepared the yarn from woollen waste, artificial wool and cotton, and these mills had a great effect in reducing the sale of goods made by large manufacturers of irreproachable integrity.

The state of trade in 1884 was so bad that several mills were closed, and others reduced the number of working hours. Many hands were thrown out of employment and were only able to exist through the attention given to their condition by the large mill owners, who opened cheap dining rooms and in other ways voluntarily assisted them.

From the latter part of the year 1886 an improvement in the woollen manufacturing industry was noticed, although the improvement was comparatively slow, and was principally apparent in the manufacture of napless goods, ordinary woollen goods remaining almost in the same condition as in the sixth decade. At the same time it must be acknowledged that the general production during the period 1880 to 1890 developed considerably, in comparison with the years 1870 to 1880. (See diagram A, Fig. 1.)

With reference to the quality of production it must be remarked that great studies and alterations have been made of late years. Up to the commencement of the eighth decade, as is seen by glancing at the diagram, both branches of the woollen industry, the fabrication of cloth and the making of napless woollen and half woollen textures, developed parallel with each other. At the end of the seventh decade, both branches acquired a considerable increase, and then the manufacture of cloth fell rapidly, but at the same time that of napless goods, which at the present time does not fully comply with the demand, remained almost unaltered. Thus, of late years an

increased manufacture of napless texture is noticed, owing to the influence of fashion, which is causing them to come more and more into use.

The increased manufacture of combed wool goods has had a beneficial effect on the condition of combed wool spinning. The latter up to the eighth decade developed very slowly and consisted of very few mills, having a total of spindles not exceeding 40,000 in number. From the year 1880 woollen spinning progressed rapidly and during the last ten years, large mills have made their appearance one after the other. The manufacture of combed yarns is developing very rapidly in the Polish district, whereas, in the Moscow district, during the last twenty years, no changes have been made in this respect. At the present time, three-quarters of the number of spindles in the Empire are at work in Poland.

RAW MATERIAL AND ITS QUALITIES.

The greater portion of the raw wool used in the Russian manufactories is home-grown, and the remainder is imported. For coarse goods common Russian wool is exclusively used; for fine, native and foreign merinos. But unfortunately it is impossible to give authentic official data of the quantity of wool used in the Russian industry, although an approximate idea may be obtained in respect to the merino wool from the following statistics: the total amount collected in Russia is about 2,000,000 pounds, of which 500,000 pounds are sent abroad, so that Russian mills consume 1,500,000 pounds of native raw wool. The total amount of common wool collected in European Russia may be approximately estimated at 5,000,000 pounds, of this amount a part goes to the mills, part for home use and the remainder is sent abroad.

With respect to the character of Russian merino wool, investigations made by a special committee, appointed by the Minister of Crown property, show that the Russian sheep farmers aim in the following direction. The predominating breed of sheep is the so-called *shtofni* (silk-wool), which gives half combing wool, with a staple reaching six centimetres. Their wool is used for making teased and smooth woollen textures. The opinion of the Commission is that under the existing circumstances, such a direction in sheep farming is the most correct, and the South Russian sheep farmers should adhere to it. The Kharkov Wool Company shows that this is the wool mostly used by Russian manufacturers, consequently it has a natural home market. Secondly, taking into consideration the economic and climatic conditions of the country, this breed of sheep, possessing as it does a strong organism in consequence of which it is not exacting in respect to food, and being furnished with a fleece of close staple, is able to withstand the severe winters.

Combing wool occupies the second place in the sheep farming industry, being used for the preparation of unsoured tissues only. Although this branch already possesses a fully acclimatized breed of sheep (*infantado*), corresponding to the German combing wool type, still it cannot yet be placed in the position it should occupy, as the preparation of combed wool has only latterly commenced to develop to any great extent. It is to be hoped that with the growth of the industry and the increased demand for combed yarn this branch will occupy a position as influential as

that occupied at the present time by the silk-wool sheep. The production of short, fine breed wool, with a staple of four centimetres, occupies the last place. Under the influence of fashion, which has favoured smooth, unscoured cloth, and owing to the decline in the woollen industry, the high position once occupied by this branch has necessarily surrendered to the two preceding branches.

Russian spinneries are supplied with foreign as well as with native wool. The import for the fifteen years from 1877 to 1891, is estimated as follows:

YEARS.	Various wools, raw combed, dyed and artificial.	I N C L U D I N G.				Value of va- rious wools imported.	
		Raw wool.	Combed, dyed and artificial.	Dyed wool excluding combed dyed.	Artificial wool.		
		In thousands of pounds.					In thousands of paper roubles
1877. . . .	202	—	—	—	11	3,539	
1878. . . .	446	—	—	—	28	8,582	
1879. . . .	647	—	—	—	30	12,590	
1880. . . .	528	—	—	—	14	9,490	
1881. . . .	473	—	—	—	5.8	10,108	
Average	459	—	—	—	17.8	8,862	
1882. . . .	509	—	—	168.1	7.9	11,845	
1883. . . .	380	216.7	47.3	45	71	10,192	
1884. . . .	301	182.6	61.4	24	33	7,923	
1885. . . .	374	250.4	65.6	24	34	9,205	
1886. . . .	310	181.4	71.6	22	35	7,418	
Average	341.3	207.8	61.4	22.8	43.3	8,685	
1887. . . .	308	139.5	119.5	23	26	7,795	
1888. . . .	550	346.5	148.5	43	12	13,502	
1889. . . .	492.3	271.8	176.5	34.1	9.9	9,573	
1890. . . .	416	197	189	20.6	9.4	14,100	
Average	441.6	238.7	158.4	30.2	14.3	11,243	
1891. . . .	337	203	116	18 *	—	10,296	

Taking into consideration that under the heading of raw wool, scoured wool which loses about 20 per cent in scouring forms a principal part, it may be estimated that about 380,000 pounds of pure woollen fibre (raw wool, combed and dyed) are collected. Bearing in mind that one pound of clean wool is obtained from three pounds of unscoured, it may be presumed that the amount of foreign wool imported is equal to 1,100,000 pounds unscoured. Thus the total amount of unscoured merino wool used in Russia is about 2,600,000 pounds.

* Artificial wool is included in this quantity.

A considerable amount of raw material, imported into Russia, is used for the spinning of combed wools. The principal part of this is received in the combed state, the quantity of late years being about 160,000 pounds, which is equal to 475,000 pounds of unscoured merino wool, and the remainder is received uncombed. The import of foreign raw material is accounted for in the following manner: merino wool of medium fineness is produced in Russia in quantities considerably above the demand for home manufacture. In the combing-wool industry a fibre from two to three inches long is required, of which a sufficient quantity is found in the regions of the Don. Wool in the Kharkov government is finer than that of the Don, but is too short in staple and is more suitable for carding than combing. But notwithstanding the considerable production of merino wool it is partly imported, the reason assigned being the more rapid development of the spinning than of the combing department, in consequence of which there arises a necessity for foreign combed wool.

The impossibility of procuring fine classes of wool in the Empire obliges Russian manufacturers to refer to foreign markets, notwithstanding that a considerable duty has to be paid on imported material. Although Russian combing wools from the districts of Rostov-on-Don and Novorossisk, and also wool from several noted sheep farmers, may be with justice acknowledged as first class products, at the same time generally speaking they cannot be classed higher than second quality, as the first sort AAA is not met with; and for the manufacture of yarns of first quality Russian manufacturers are obliged to have recourse to foreign products. It should be stated that fine wool, AAA and AA, required for combed wool spinning, is three to four time less than the classes A, B and C. Consequently Russian sheep are in a position to supply the greater part of the home demand. Wools are received from Buenos Ayres and from the colonies Sydney, Adelaide and Port Philip. The quality of colonial raw material in general must be acknowledged to be higher than Russian in respect to fineness: also each of the large number of different kinds of colonial wool has its own distinct and constant type, whereas several of the Russian kinds, often in consequence of incorrect farming and breeding, vary in quality.

Of the quality of raw material used in Russian manufactories a clear insight may be obtained from the interesting statistics, given by one of the large Russian woollen spinneries and fully substantiating the above mentioned position; this mill during three years bought in the Don district about 300,000 pounds of unscoured merino wool, which after sorting gave the following results:

CLASSES OF WOOL.	1889.	1887.	1888.
	T h o u s a n d s o f p o u n d s .		
AA.	2.24	0.49	0.26
A twist.	29.30	21.50	24.70
A weft	12.43	13.52	15.58
B	33.86	39.96	47.63
C	7.74	17.43	13.56
Waste *	2.78	2.71	3.16

* By waste is understood, wool which is unfit for combed spinning; it is sold at a low price to woollen mills.

From these statistics it will be seen that Russian wool does not include any of the very fine brand, AAA. Wool of the second degree of fineness, AA, is contained in small quantities in the Russian fleece, and a gradual depreciation in this respect is yearly noticeable. The same condition is seen in France. According to the investigations of the Industrial Society of Rheims, the fineness of the fibre of French merino wool has depreciated 20 per cent during the last thirty years. In the year 1889 the manufactory produced 75,000 pounds of twist, weft and doubled yarns, class AAA, class AA and classes A, B and C. One-half of the necessary amount of combed wool was prepared in the mill and the other half was procured from foreign markets. For the manufacture of yarns classes AAA and AA wool were imported, part of which was combed and part was scoured.

Artificial as well as natural wool is brought into Russia, but the import latterly has diminished visible and at present amounts only to about 14,000 pounds per year. There are eighteen artificial woollen mills, scattered in the Polish district, possessing breaking machinery for preparing such product, with a total production of about 200,000 pounds. This material finds a market, owing to its cheapness. Taking the price of woollen rap of low quality at from 60 kopecks to 3 roubles per pound for cloth, flannel and hosiery, and from 3.50 to 6.50 roubles for higher class, as thibet and clean kangarn, artificial wool in a finished state is valued at from 1.50 to 15 roubles per pound.

Weft yarn is prepared from artificial wool with a mixture of 15 to 85 per cent of natural wool, or of cotton, for the better union of the short fibres and for strengthening the yarn. The adoption of artificial wool in the preparation of cloth is a thing not to be desired on account of the non-durability of the textures made from it, and because of the possibility of making at home fabrics of normal strength and quality. At the same time, the use of artificial wool for the under-weft may be acknowledged as suitable, and reduces the cost of manufacture. Although in Russia, the manufacture of artificial wool up to the present time has developed comparatively rapidly, still at the same time it may be definitely stated that it has not extended to such a degree as abroad, for instance in Germany and Austria. In Germany according to investigations by Grothe and Hühnel, instances are very rare where artificial wool is not used in fulled woollen textures.

A check to the development in Russia of this undesirable branch of the woollen industry has been given by the customs tariff measures, namely, the imposing of a considerable duty on artificial wool itself, as well as on foreign rags, which are more or less indispensable in the manufacture of higher classes of this wool. Russian manufactories cannot dispense with foreign materials, as Russian rags are coarser, and as the woollen rag business in Russia, in general, is not so well organized as abroad.

IMPORT OF FOREIGN GOODS.

Carded woollen yarns are imported only in insignificant quantities as the home product is sufficient to supply the demand for home weaving. With respect to Saxon and English combed yarns, Russian woollen spinners turn out much too little to supply the constantly increasing manufacture of unfelted goods.

The import of various yarns over the European frontiers for the last fifteen years is shown in the following data:

POUNDS AND PAPER ROUBLES IN THOUSANDS.								
Years.	Pounds.	Roubles.	Years.	Pounds.	Roubles.	Years.	Pounds.	Roubles.
1877 . .	153	7,987	1882 . .	299	16,872	1887 . .	196	9,727
1878 . .	349	15,905	1883 . .	231	12,239	1888 . .	236	11,069
1879 . .	332	17,105	1884 . .	202	10,684	1889 . .	209.7	9,172
1880 . .	294	14,916	1885 . .	252	12,244	1890 . .	141	6,586
1881 . .	275	13,944	1886 . .	240	11,137	1891 . .	117	5,699
Average	281	13,971	—	245	12,635	—	180	8,451

As has been shown above, the given figures principally characterize the import of combed yarns. On examination of these statistics one must be convinced of the gradual decrease in the use of foreign manufactures. Such a state of affairs cannot be accounted for solely as the result of the customs tariff measures; it depends principally upon the considerable measure of the development of the home industry. During the last ten years combing spinneries have been founded in quick succession, and woollen spinners, after considerable stagnation, have made visible and rapid progress. It is true that the newly opened mills use foreign raw material extensively, and that the import of combed wool for the period 1887 to 1890 increased two and one-half times, in comparison with the four previous years. At the same time, such an increase in the import did not have any effect on the interests of Russian sheep farming, which suffered equally from the import of raw, semi-prepared and finished wool. Nevertheless, the substitution of imported raw material for imported fabrics has without doubt tremendous significance in favour of the industry itself. Certainly if the periods of 1882 to 1886 and of 1887 to 1890 be compared it will not be difficult to arrive at the conclusions that the value of imported yarns and wool for the latter period decreased 1,600,000 roubles; that the import of yarns diminished 65,000 pounds; that of wool increased 100,000 pounds; and that the greater part of the latter amount (97,000 pounds) fell to the lot of combed wool in the sliver.

Taking 95 per cent as the issue of yarn from a unit of wool, it is found that Russian spinneries, having used 97,000 pounds of foreign combings, deliver to the weavers about 92,000 pounds of yarn, which at the average cost of 65 roubles per pound for № 56 yarn, forms a value of about 6,000,000 roubles. Thus, owing to the import of combed wool in the sliver, which was necessary on account of the development of spinning, the import of yarn decreased, in consequence of which 7,600,000 roubles remained in the Empire. This sum under other circumstances namely the prohibiting the import of foreign combed wool, would have been paid to foreigners for prepared yarn, as all those spinneries which did not possess combings would have been unable to work. Out of the total of 150,000 spindles for spinning combed yarn from 50,000 to 75,000 of these up to the present time are not supplied with their own combing departments, as may be judged from the amount of imported combed wool.

The import of woven (felted and napless) and knitted goods for the years from 1877 to 1891 is shown in the following table:

POUNDS AND PAPER ROUBLES IN THOUSANDS.								
Years.	Pounds.	Roubles.	Years.	Pounds.	Roubles.	Years.	Pounds.	Roubles.
1877 . .	76.6	6,547	1882 . .	91.7	8,962	1887 . .	33.7	2,680
1878 . .	119.1	10,538	1883 . .	65.7	6,520	1888 . .	31.6	2,309
1879 . .	140.9	12,321	1884 . .	51.2	5,468	1889 . .	45.5	3,276
1880 . .	134.7	12,102	1885 . .	51.5	4,618	1890 . .	48.1	3,506
1881 . .	88.9	7,710	1886 . .	41.6	3,683	1891 . .	42.2*	3,307
Average .	114.0	9,844*	—	60.9	5,850*	—	40.2	3,016*

From the above statistics it will be seen that the import of foreign goods, estimated generally in small quantities, gradually diminishes, the latter period showing a decrease of 33 per cent as compared with that from 1877 to 1881. Russia is principally supplied with napless goods, the import of which for the period 1877 to 1881 is twelve and one-half times greater than that of felted goods, fine cloths forming a principal part of the latter. The comparatively large amount of combed wool goods imported is accounted for as follows: Notwithstanding the rapid progress made in spinning in Russia of late years part of the material required for the manufacture of light woollen and half-woollen textures up to the present time has to be imported. In the same manner in respect to fashionable colours and designs for these goods, the home woollen weaving mills are also dependent upon the varying demands, which are regulated abroad, principally in France.

The total value of import of woollen yarns and goods is considerable in comparison with the home production, as is apparent from the following comparison of values of imports and the amount of yearly output in the manufacture of woollen textures.

PERIOD OF TIME.	Relative value of imported wools and yarns to yearly turnover.	Relative value of imported woollen goods to the yearly turnover.
PER CENTS.		
1855—1859. . .	11	7
1860—1864. . .	11	8
1865—1869. . .	16	10
1870—1871. . .	27	21
1875—1879. . .	30	16
1880—1884. . .	27	9.5
1885—1889. . .	26	5

* Including the value of Turkish goods.

** Excluding knitted goods.

As may be seen from the data given, the increase in the import of raw wool and yarns confirms the statement already made, that sheep farming and wool spinning in Russia do not develop in the same degree as the weaving of woollen textures, in consequence of which recourse must be had to foreign markets to make up the insufficient supply of materials. As regards the wool-weaving industry the same statistics show that from the middle of the seventh decade foreign stuffs began in a great measure to be replaced by those of Russian manufacture, and at present the production almost suffices for home requirements.

In valuing the import into Russia of wool and woollen goods it is interesting to become acquainted with statistics of the Russian export trade. Common and merino wools, combings, cloth cuttings, goat hair, woollen yarns and goods are exported from Russia. The principal object in the foreign trade is raw wool, the export of which from 1869 to 1891 is explained in diagram, Fig. 3, showing: A. exports over European frontiers of common Russian wool; B. unscoured merino; C, scoured merino. Exports were made also over Asiatic frontiers, but in considerably smaller quantities; during the years 1860 to 1890 about 190,000 pounds, to the value of 1,273,000 roubles, were exported annually, which consisted solely of common wool.

FIG. 3.

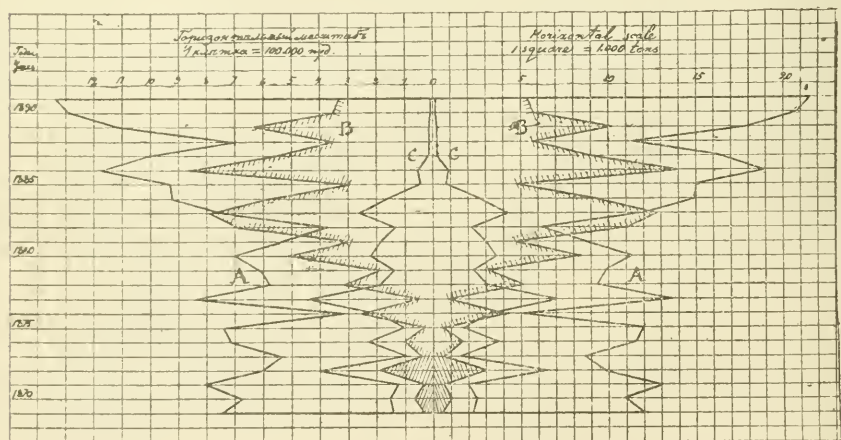


Fig. 3. Diagram showing exports over European frontiers: A, common Russian wool; B, unscoured merino; and C, scoured merino; on the left, in hundreds of thousands of pouds, and on the right, in thousands of tons.

On examining these diagrams the following conclusion is reached. The export of wool undergoes considerable fluctuation; that of common wool increases, and merino on the contrary decreases, especially of scoured merino. Comparing the diagram of export of wool with that of import, D, various wool, E, various, excepting combed, and F, combed in the sliver, it must be acknowledged that the exports con-

siderably exceed the imports. In reference to the merino wool trade, the import of foreign material is nearly three times greater than the export.

The export principally consists of common Russian wool, as is seen from the following data of the average annual exports over the European frontier, for the last three periods of five years each.

FIG. 4.

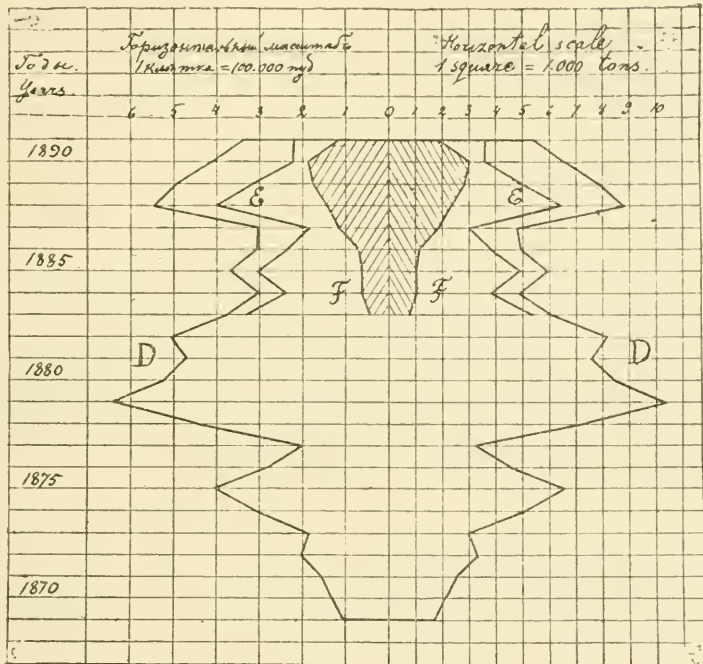


Fig. 4. Diagram showing imports over European frontiers: D, various wools; E, various, excepting combed; F, combed, in the sliver; on the left, in hundreds of thousands of pounds; on the right, in thousands of tons.

FIVE YEARS PERIODS.	Common	Merino wool.	
	Russian wool.	Unscoured.	Scoured.
	IN THOUSANDS OF POUNDS.		
1877—1881. . .	655	227	249
1882—1886. . .	635	645	134
1887—1891. . .	1,094	449	10

Besides raw wool, woollen goods, although in small quantities, are exported from Russia. Their export over the European frontier is shown as follows.

YEARS.	Various woollen materials.	Including		YEARS.	Various woollen materials.	Including		YEARS.	Various woollen materials.	Including	
		Cloth.	Felt.			Cloth.	Felt.			Cloth.	Felt.
In pounds.				In pounds.				In pounds.			
1877	24,595	2,538	—	1882	27,757	3,693	—	1887	30,147	1,401	26,371
1878	23,847	11,988	—	1883	25,474	3,885	17,403	1888	36,859	7,378	27,944
1879	25,273	13,293	—	1884	23,486	2,154	15,611	1889	49,410	15,460	32,616
1880	40,626	29,555	—	1885	46,408	24,145	20,230	1890	35,098	10,074	23,538
1881	54,210	45,595	—	1886	33,551	13,219	18,284	—	—	—	—
Average	33,710	—	—	Average	31,335	—	—	Average	37,879	—	—

The average value of annual exports for the last ten years amounts to about 970,500 roubles. Various woollen goods at the present time are exported yearly over the Asiatic frontier to the value of 1,500,000 roubles and consist chiefly of carpets, felt and cloth, of which the principal part, to the value of 530,000 roubles yearly, is sent to Kiakhita. The foreign trade in Russian cloths has fallen considerably in comparison with that of the sixth decade, when the commercial transactions with China and Persia reached the sum of 3,500,000 roubles.

YEARLY OUTPUT AND TECHNICAL MEANS OF THE INDUSTRY.

According to statistical information, the condition of the woollen industry of late years is shown by the following official data.

YEARS.	OUTPUT IN MILLIONS OF ROUBLES.							Number of mills.	Number of work-people in thou- sands.
	Wool washing.	Wool spin- ning.	Cloth mann- factures.	Wool weaving manufacture of napless, wool- len and half- woollen texture.	Carpet mak- ing.	Felt mann- facture.	Manufacture of knitted goods.		
1880. . .	15.4	13.6	63.3	36.7	—	—	—	1,191	111.6
1881. . .	12.3	14.8	56.5	36.5	—	—	—	1,211	104.1
1882. . .	15	19.1	52.7	36.8	—	—	—	1,304	111.4
1883. . .	11.9	15.9	46.5	35.4	—	—	—	1,300	98.9
1884. . .	7.3	12.5	44.8	31.9	0.6	0.3	1.1	1,127	93.8
1885. . .	5.3	14.3	42.8	35.2	0.6	0.2	1.1	947	98.2
1886. . .	6.9	19.1	40.8	33.4	0.5	0.3	1.3	941	90.2
1887. . .	7.2	19.4	43.9	34.3	0.9	0.4	1.6	987	75.6
1888. . .	7.9	20	46.1	37.1	0.9	0.4	1.7	1,090	107.2
1889. . .	8.5	20.1	42.7	33.9	1.1	0.6	2.1	1,085	99.9

As is seen from the foregoing data the manufacture of cloth should occupy the first place in respect to the amount of yearly turnover. As regards quality, this branch of the industry is principally devoted to the production of goods of medium fineness, although at the same time there are many manufactories in Russia producing fine cloths in no way inferior to those of foreign make. The cloth industry is almost wholly supplied by yarns of home manufacture. Carded wool spinneries are principally situated near the weaving mills.

There are no very large mills that make spinning a specialty, but there are many small ones engaged in the preparation of yarns for coarse and medium kinds of textures. The manufacture of napless goods is noticeably developing. For a long time this branch of the industry was in an inactive condition, in consequence of a considerable part of the necessary material, combed yarn having to be imported. As has been before mentioned, up to the present time considerable progress has been made in combed wool spinning, and the wool-weaving industry becomes yearly more and more independent of foreign manufacturers.

In the foregoing data relating to wool spinning, a considerable part of the output should be apportioned to the preparation of combed yarns. Then with the given statistics it is possible to judge what progress has been made during the period 1880 to 1889 in combed wool spinning. The majority of the spinning mills, started of late years, managed, at least at the beginning, without wool-washing and combing establishments, receiving wool in the combed state from abroad, a natural state of affairs. The preparation of combed yarns is without doubt considered by all as a very complicated process. Washing and combing operations require quite as much capital as wool spinning. Therefore the division of this manufacture into two special branches, the same as abroad, is desirable. Russian combed wool spinning consists of about 150,000 spindles capable of producing 300,000 pounds of yarn per year, which amount is insufficient to supply the wants of the wool-weaving industry. The import of various yarns of late years has been 180,000 pounds, consisting principally of combed yarn.

Relying on the example of the west, one would think that the first aim of the industry should be the development of spinning mills, even without combing departments, to such an extent as to make them capable of adequately supplying the home demand for combed yarn. As soon as wool spinning reaches this state the second endeavour should be to make this a home branch of the industry in all its stages. For this, first of all, capital is required for the erection of spinning mills and when competition arises amongst producers of combed yarn within the Empire, then by gradually checking the import of foreign combed wool, spinning mills may be directed to the using principally of Russian wools, for the preparation is not of all kinds of yarn, at any rate those below AA. When such a state of things has arrived it may be expected that an independent industry of wool scouring and combing will gradually arise in Russia, and that Russian wool will be exported, not only in the raw, but in a half-fabricated state, scoured and combed.

As regards other branches of the woollen industry, devoted to the production of carpets, felt and knitted goods, the output is not of much consequence. It is true, these products partly form articles of rustic trade; for instance, in the government of Viatsk cheap carpets and rugs are manufactured in considerable quantities and find a sale in carriage-building establishments and at the Nizhni-Novgorod fair; in

the Caucasus the rustic manufacture of the so-called Persian carpets is widely spread: therefore, the registration of establishments supplying them is very difficult, so that the turnover of the above-mentioned branches is greater than is shown by official statistics. At the same time there is comparatively little development in the manufacture of such articles in mills, but the rustic trade or handicraft often distinguishes itself in respect to quality and design, especially in the district beyond the Caucasus and in Central Asia. The reason of this condition in respect to carpet manufacturing is: first, the comparatively limited use of such carpets as are articles of luxury, beyond the reach of the majority of the inhabitants, and are substituted by printed felt carpets, or hemp and jute floor cloths, which are inexpensive, and are prepared in large quantities; secondly, this industry is also retarded by its dependence on foreign manufactories for acquiring the necessary materials. Thus, for the fabrication of fancy carpets, cut or speckled, it is necessary to import woollen warps, printed in colours: for the preparation of carpets from dyed warps, Jacquard, it is very often necessary to have recourse to foreign goods, for the cards for Jacquard looms, as there are so many different designs.

As regards the technical means for the manufacture of woollen goods, according to statistics by the Department of Trade and Manufacture, embracing more or less the larger mills, with an annual turnover of more than 2,000 roubles, there were in 1889, 479,993 spindles; 150,000 of these were engaged in the spinning of combed yarns, and the remaining 330,000, devoted to the preparation of carded wool. The number of looms occupied in the production of woollen and half-woollen napless cloths in the same year was 34,349. In reality the number of looms engaged in the production of woollen goods is considerably more, as there are many rustic establishments, statistics of which are not forwarded to the Department. In 1879, according to official figures, there were 309,964 spindles and 25,898 looms at work. Thus during a period of ten years the increase in the number of spindles was nearly 55 per cent, and in looms, nearly 33 per cent.

In order to value the commercial side of the manufacture of woollen goods, the average costs of fabrications in all their different stages, as well as the cost of raw material and finished goods must be taken into consideration. The cost of spinning combed yarns in Russia may be ascertained from the following information, derived from the accounts of a large typical woollen spinning mill, situated in the Polish district, this district being selected because it occupies an influential position in the development of combed wool spinning. This manufactory produces combed yarn from combings, half of home preparation and half imported of the following fineness and qualities: AAA, Nos. 75 to 96: AA, Nos. 64 to 75: A, Nos. 20 to 74; B, Nos. 24 to 64; C, № 32. * The yearly production of the spinning department, working day and night for 295 days, 6,781 working hours, amounted to 55,000 pounds of yarn, medium counts № 55.8 or 50,334,096 hanks, so that the average production per spindle in 12 hours, taking into consideration that 7.66 per cent of time is lost in stoppages, doffing and the like, was four and one-quarter hanks, 75.5 grammes, the old self-actors producing 20.5 per cent less than the new ones. The average issue was as follows:

* A hank contains 1000 metres. The № is arrived at by the number of hanks in a kilogram

Russian unscoured wool lost in washing 67 per cent; from scoured wool 78.5 per cent of combings were derived, or from unscoured 27 per cent; and lastly 93 per cent of yarn was obtained from combings; waste, 5.5 per cent and dead loss, 1.5 per cent. The yearly production in the combing department was 30,786 pounds, at an expenditure of 18,234 roubles for wool sorting, 31,093 roubles for combing, 53,347 roubles for material, 27,410 roubles for the amortization of machinery and buildings, excluding interest or invested capital, as this item is shown in the spinning department and in the profits of the manufacturer, and total, 130,084 roubles. In this manner the cost per pound of combings was 4.15 roubles. The annual expenditure in spinning 50,334,096 hanks of yarn was as follows: wages, 129,930 roubles; fuel, 11,451 roubles; lighting, 4,461 roubles; materials, 78,027 roubles; duty and freight, 10,943 roubles; tools for re-mount, 3,283 roubles; re-mount, 5,946 roubles; insurance, 8,304 roubles; amortization of machinery and buildings, 50,053 roubles; bank interest, 14,310 roubles; sundry expenses, 34,666 roubles; profit, 42,978 roubles; total, 394,352 roubles. Consequently, the spinning of one hank of yarn from combings costs 78 kopecks, or 7.16 roubles per pound of № 56. Twofold doubling costs half a kopeck per hank.

Taking 27 per cent as the issue of combings from raw wool, that is, one pound out of 3.7 pounds of unscoured wool, and the cost at 12 roubles per pound, it is found that it takes 44.40 roubles worth of raw wool to make one pound of combings, and together with the cost of production, 48.55 roubles. Then taking the issue of yarn from a unit in weight of combings at 95 per cent, one pound of yarn of average № 56 would cost 51.17 roubles in combings, and 7.16 roubles in spinning, making a total of 58.33 roubles. As part of the waste is re-used and part sold, 95 per cent may be taken as the issue of yarn from a unit in weight of combings.

In the manufacture of carded woollen yarn the cost per pound, in spinning the kinds principally used, is as follows:

	Spinning.	Doubling.
	Roubles.	Roubles.
1. In hanks *	4.40 — 4.40	
2. »	4.80 — 5.20	$\frac{2}{2}$ hanks — 1.60
3. »	5.20 — 6.00	$\frac{3}{2}$ » — 1.60
4. »	5.60 — 6.40	$\frac{4}{2}$ » — 2.00
5. »	6.00 — 6.80	$\frac{5}{2}$ » — 2.40
6. »	6.00 — 7.20	$\frac{6}{2}$ » — 3.00
7. »	6.80 — 8.00	$\frac{7}{2}$ » — 4.00

One pound of medium yarn, three-fourths of a hank, costs in wool 23.80 roubles: in spinning, 5.50 roubles; total, 29.30 roubles. For finer yarns a more expensive wool is used, 40 to 50 roubles per pound. As regards the cost of producing textures on account of great variety in quality of material and the processes of finishing, it is impossible in a short review to give full particulars. Consequently only the more or less definite kinds of goods will be considered.

The following table may be of interest in this connection:

* A hank contains 2,000 arshines of yarn, and the counts of the yarn are arrived at by the number of hanks in one Russian pound.

CLASS OF GOODS.	QUALITY AND COST OF YARNS.		COST OF PRODUCTION PER PIECE.			COST PER AR-SHINE.
	Twist	Weft.	Weaving.	Dyeing and finishing.	Expenses.	
R o u b l e s.						
Sateen A, width 15 vershoks, length 59 arshines.	N ^o 100 ¹ / ₂ cotton 4 ¹ / ₂ pounds, 5.63 roubles.	N ^o 70 Botany weft 6 ⁵ / ₈ pounds, 11.04 roubles. . . .	1.65	3.50	5.03	0.46
Sateen. AA width 15 vershoks, length 59 arsh.	N ^o 90 ¹ / ₂ cotton 5 pounds, 6.25 roubles.	N ^o 70 Bot. weft 7 ¹ / ₂ pounds 12.50 roubles.	1.80	3.75	5.60	0.51
Cashmire, 26 vershoks wide. 52 arsh. long.	N ^o 52. Saxon AA, 5 ³ / ₄ pounds 9.13 roubles.	N ^o 74 Saxon AA, 10 pounds, 16.57 roubles. . . .	2.40	5.00	7.66	0.73
Cashmire, Indian super 25 vershoks wide, 57 arsh. long.	N ^o 112 ¹ / ₂ Saxon AAA, 6 ¹ / ₃ pounds, 15.83 roubles.	N ^o 96 Saxon AAA. 10 ³ / ₄ pounds, 22.35 roubles. . . .	3.40	6.00	11.04	1.05
Lustre, 17 vershoks wide, 55 arsh. long.	N ^o 120 ¹ / ₂ cotton 3.34 roubles.	N ^o 36 super lustre, 6 ¹ / ₂ pounds, 18.13 roubles. . . .	0.80	1.50	1.60	0.23
Repps, 29 ¹ / ₂ vershokswide, 60 arsh. long.	N ^o 46 ¹ / ₃ woollen 40 pounds, 39.33 roubles	N ^o 46 ¹ / ₃ woollen 26 pounds, 25.57 roubles.	8.92	—	17.36	1.52
Flannel cheviot, 29 ¹ / ₂ vershoks, 132 arshines long.	4 hank. 47 ¹ / ₂ pounds, 49.30 roubles.	4 hank. 26 pounds, 42.43 roubles. . . .	26 r. 28 k.		5.76	0.94
Woollen shawls 2 arshines, 7 vershoks square, 26 pieces.	3 hank. 46 pounds. 39.33 roubles.	3 hank. 47 ¹ / ₂ pounds, 40.62 roubles. . . .	16 r. 77 k.		2.60	3.82*
Carpets: 15 ¹ / ₂ vershoks wide. 60 arsh. long.	Wool, cotton and jute	Flax yarn.		Carpet cleaning.		
	R O U B L E S.					
a. Figured velvet	64.61	6.60	9.56	0.60	16.27	1.63
b. Spotted velvet	49.30	4.05	7.47	0.60	12.00	1.23
c. Plain velvet.	87.72	6.60	10.12	0.60	21.00	2.10
d. Josquard. .	116.40	15.00	18.00	0.60	20.00	3.00

* Cost per shawl.

In settling the question of cost of production of goods, and for explaining more clearly the commercial side of the industry, the data, showing the fluctuations in the price of raw wool and woollen yarn in Russia, will be found useful. Prices of wool per pound have undergone the following changes during the late years:

PRICES OF WOOL IN RUSSIA *						PRICES OF WOOL IN FRANCE **.	
YEARS.	Russian wool.	Spanish wool.			Australian A and AB scoured.	No 1, Buenos Ayres and Monte Video scoured.	Rate of exchange, 1 rouble gold = 1.50 rouble paper
		Unscoured.	Sorted.	Scoured.			
		In roubles.					
1878 . .	6 ³ / ₄ —7	11 —12 ¹ / ₂	—	35 ¹ / ₂ —38 ¹ / ₂	51 ¹ / ₂ —54 ¹ / ₂	51 —51	
1879. . .	8 —9 ¹ / ₂	11 —14	—	35 —45	49 ¹ / ₂ —43 ¹ / ₂	52 ¹ / ₂ —40 ¹ / ₂	
1880. . .	9 ¹ / ₂ —13	11 ¹ / ₂ —13 ¹ / ₂	18 —24	31 —41	49 ¹ / ₂ —45	43 ¹ / ₂ —45 ¹ / ₂	
1881. . .	8 ¹ / ₄ —12 ¹ / ₂	9 ¹ / ₄ —12	17 —23	30 —37 ¹ / ₂	43 ¹ / ₂ —45	42 —42 ¹ / ₂	
1882. . .	7 ¹ / ₂ —12	9 —12	16 ¹ / ₂ —24	28 —39	43 ¹ / ₂	43 ¹ / ₂ —43 ³ / ₄	
1883 . .	7 ¹ / ₂ —11 ¹ / ₄	9 —12 ¹ / ₂	16 —23	27 —36	45 —43 ¹ / ₂	45 —43 ¹ / ₂	
1884. . .	7 ³ / ₄ —10 ³ / ₄	9 ¹ / ₄ —12 ¹ / ₂	16 —23	28 —31 ¹ / ₂	43 ¹ / ₂ —42	44 —40 ¹ / ₂	
1885. . .	7 —10 ¹ / ₂	8 —9 ¹ / ₂	14 —20	27 —32 ¹ / ₂	42 —34 ¹ / ₂	41 —32	
1886. . .	7 —13	7 —11 ¹ / ₂	11 —24	24 —36	30 —40 ¹ / ₂	32 —33	
1887. . .	7 —12	8 —10	13 —21 ¹ / ₂	28 —35	39 —34 ¹ / ₂	33 —33 ¹ / ₂	
1888. . .	7 —11	9 —11 ³ / ₄	13 —24	33 —38 ¹ / ₂	34 ¹ / ₂ —36 ¹ / ₂	33 ³ / ₈ —37 ¹ / ₂	
1889 . .	6 ¹ / ₂ —10 ¹ / ₂	8 —10 ³ / ₄	12 —23	31 —35	37 ¹ / ₂ —42	36	
1890. . .	5 ³ / ₄ —9 ¹ / ₂	7 —10 ¹ / ₂	12 —22 ¹ / ₂	29 —35	39 —37 ¹ / ₂	36 —34 ¹ / ₂	
1891. . .	6 —9 ³ / ₄	7 —9	12 —21	29 —31 ¹ / ₂	—	—	
1892. . .	6 —10 ¹ / ₄	7 ¹ / ₂ —8 ¹ / ₂	13 ¹ / ₂ —21	29 —32	—	—	

From these data it is seen: 1. that in Moscow the highest prices for Spanish wool were, in 1879 to 1880, 11 to 14 roubles per pound, unscoured, 18 to 24 roubles, rectified, and 35 to 45 roubles, scoured; 2. that from 1880 to 1886 and 1888 they constantly fell and quickly rose for a time; 3. that after the temporary improvement started, the fall in the price again commenced, continuing up to the present time. The prices of Russian common wool fluctuated with those of Spanish wools, as is evident from the foregoing table; the highest price was in 1880, after which it fell until 1886, and after a three years rise, 1886 to 1888, again began to fall. The causes of the fall in price of Russian wool, which seriously affects the interests of the Russian sheep farming, are various, the prices being dependent upon the condition of sheep farming itself, upon the demand not only of Russian, but of

* According to quotations on the Moscow Exchange.

** From data given by a large French wool-combing manufactory.

foreign markets, and also upon the direction of the wool-weaving industry. The foregoing table shows us an existing relative fluctuation in price of wool in the Russian and French markets.

The investigation of the fluctuations in prices of woollen yarn is more complicated than that of raw wool, as it is a product very irregular and varying in quality, according to the demands of the market. The following data show the fluctuation of prices in the Moscow region. According to quotations on the Moscow Exchange the price per pound in roubles for combed and carded yarns underwent the following changes:

YEARS.	Saxon twist № 32 A, AA, AAA.	Saxon weft № 38—40 B.	English weft № 36.	Carded twist № 9—11.	Carded weft № 9—11.
1879	72—80	67—71	43—54	47—48	49—50
1880	76—80	68—86	50—59	47	48
1881	68—74	67—71	44—56	46	47
1882	68—72	—	45—53	43	43
1883	72—77	63—68	44—53	42	42
1884	72—77	63—68	44—52	43	43
1885	65—75	61	45—54	37—37½	36—37
1886	60—66	42—58	43—52	34—36	31—35
1887 1 half . .	76—88	73—78	48—53	43	41
1887 2 half . .	72—85	64—72	50—57	42	40
1888	74—82	67—70	46—62	—	—
1889	62—72	60—65	47—53	39—43	—
1890	50—55	49—54	46—54	—	—
1891	52—63	51—59	45—55	—	—
1892	52—59	48—52	49—56	—	—

According to the data given there is a rapid increase in the price of yarn in 1879 to 1880, after which it falls until 1886, when again a rise is observable. A comparison of the variation in the price of wool and yarn shows that they follow parallel with each other, the only difference being the amount of time lost at the moment of their variation. The similarity in the fluctuation in the price of yarn and wool would be more complete if the alteration in the tariff did not increase the value of yarn considerably more than that of wool. The foregoing refers to combed yarn; the value of carded yarn depends little on the variation of the customs tariff, as it is a fabrication which easily withstands foreign competition.

CONCLUSION.

In summing up the preceding the following conclusion may be drawn: the manufacture of woollen felted goods, of coarse and medium classes, is fully developed and capable of supplying the home demands. Besides the considerable amount of cloth, supplied for clothing the army, the manufactories produce a no less considerable quantity of goods for the requirements of the poor, as well as for the better classes of the inhabitants. Russian manufacturers can flatter themselves that nowhere in Europe are the armies provided with better and cheaper cloth than in Russia. This manufacture of woollen felted goods should be considered all the more independent as it has a sufficiently suitable native raw material, and is in possession at the present time of an adequate supply of spindles for carded wool spinning. With regard to the fabrication of fine cloths, this branch of the industry develops comparatively slow, although lately visible progress has been made. Reverting to the manufacture of combed yarn goods it must be acknowledged that only at the present time its position is becoming more or less firm, as only for the last ten years has it had the possibility of obtaining yarn, at any rate the greater part of the amount required, of home production, through which it has acquired the right of great independence of foreign industries. For the complete success of the fabrication of combed wool goods, which gives so much hope on account of the modern condition of its qualificative element, the further development of spinning is necessary. The better this branch of Russian industry is established, the easier will it be to reach an independent position in the universal markets and the more independence will be attained by Russian sheep farming, which, with the increased home demand for wool and a suitable Government protection, will be able untiringly to develop in quantity as well as in quality.



CHAPTER IV.

Silk goods.

THE silk goods industry is, as regards quantity, in a far less developed condition than the other branches of manufacture. This admits of an easy explanation, for although silks on account of their beautiful appearance take the first place among spun stuffs, still their high price prevents their being as much used as other fibrous materials. Most of the cotton, flax and woollen goods suffice for the everyday requirements of the population, and silks may be regarded rather as objects of luxury, only attainable by the wealthier classes, and therefore they enjoy a more limited sale.

HISTORICAL SKETCH OF THE INDUSTRY.

Silk has been used in Russia from the earliest times. In ancient Russia various silk stuffs of eastern make, such as, brocade, purple, scarlet, damask, oksamite and others were used for holiday and state attire, as well as for sacerdotal robes, and later on, silks were imported from the west.

The gradual extension of the use of high-priced imported textile fabrics induced the Government to take steps towards establishing the industry in Russia. The first silk-weaving factories date from the time of Peter the First, for in 1714 several establishments for making brocades, velvet, silks and various light stuffs sprang up. These first manufacturers soon found many imitators and the silk industry, as a village trade, began to spread through the governments of Moscow, Vladimir and Yaroslavl. In 1809 the total number of factories rose to 194, of which 175 were in the government of Moscow; they contained 4,996 looms and employed about 9,500 hands. The output amounted to 7,110,000 arshines, and 505 pieces of various silk, 400,000 arshines of ribbon, 6,400 pieces of lace, and 12,600 pairs of gloves and stockings. During the war of 1812 the number of silk-weaving establishments in Moscow dwindled to 105, but the trade rose briskly after the war and in 1818 the number of

factories had increased to 210. In 1823 Jacquard looms were first introduced into the Russian factories, as in 1822 the Department of Manufactures and Internal Trade published the drawings and description of these looms and shortly afterwards one was exhibited in Moscow at the house of the Committee for supplying soldiers cloth. They began to spread widely in 1825; and in 1830 they were in use in many of the smaller factories; they were similar to those used in Lyons, Berlin and Vienna. This circumstance at once gave considerable impetus to the silk-weaving trade, greatly increasing the production, variety and excellence of the goods, so that the average for the period between 1826 and 1829 was about 5,000,000 arshines and 115,000 pieces of silk. In 1845 the value of the product of all the silk mills was 6,000,000 roubles, and in 1850 it rose 6,500,000 millions.

The further gradual development of the silk-weaving industry may be partly gauged by the amount of silk imported and worked up in the Russian mills. The following table gives the average import through the European frontier for periods of five years from 1855 to 1879:

Y E A R S.	Raw silk.	Twisted and spun silk.
	I N P O U N D S.	
1855—1859	1,690	6,106
1860—1864	794	6,255
1865—1869	2,891	8,140
1870—1874	1,926	14,934
1875—1879	1,541	19,700

This progressive increase of the import of raw material, caused by the rise of the internal production, was not accompanied by a decrease in the import of foreign stuffs, as is shown by the mean yearly import value of silk and half-silk goods for the same periods, also through the European frontier.

1855—1859	6,172,000 roubles.
1860—1861	4,087,000 "
1865—1869	4,869,000 "
1870—1874	5,920,000 "
1875—1879	4,244,000 "

Thus, although the production greatly developed, still at the same time, the demand for silk goods was so great that the home manufacturers were unable to satisfy it.

Having briefly dealt with the history of the development of the Russian silk-weaving trade a more or less detailed investigation of its condition during the last fifteen years, should be considered.

THE IMPORT AND EXPORT OF SILK GOODS.

Although Russia does not come last among the countries of Europe in the annual production of cocoons, the process of unwinding them for obtaining the raw material and the preparation of the latter by twisting and reeling, are but little developed. The Russian silk industry, according to the last revision of the tariff, uses considerably more foreign than native material, the principal kinds being Milan, Turin, Chinese, Central Asiatic or Margellan, Kokhand and Kashgar, Circassian and Persian silk. In general the Russian material is by no means equal to the foreign both as regards purity and uniformity; and in addition to this, Russian silk is not to be had lower than 50 deniers and the principal kinds required for silk weaving are organzine and tram of 22 to 28 deniers, the number of silk thread being determined by the weight of a skein expressed in deniers, the old French system being 1 skein = 476 meters, and 1 denier = .05313 grms. This being the condition of the native silk culture, it is evident that recourse must be had to foreign markets.

The following table shows the large amount of foreign material imported through the European frontier.

YEARS.	Raw and floss silk.	Tram, organ- zine, sewing and combed silk.	YEARS.	Raw and floss silk.	Tram, organ- zine, sewing and combed silk.	YEARS.	Raw and floss silk.	Tram, organ- zine, sewing and combed silk.
	IN POUNDS.			IN POUNDS.			IN POUNDS.	
1877. . .	197	10,030	1882. . .	663	22,988	1887. . .	4,708	23,001
1878. . .	2,786	24,604	1883. . .	1,221	24,071	1888. . .	13,216	26,981
1879. . .	3,666	30,558	1884. . .	1,073	22,788	1889. . .	12,488	26,908
1880. . .	6,385	24,327	1885. . .	2,526	20,956	1890. . .	13,182	23,639
1881. . .	3,835	21,951	1886. . .	3,027	21,816	1891. . .	20,400	24,500
Average .	3,374	22,294	Average .	1,702	22,524	Average .	12,799	25,006

The value of the goods in the first column during the last five years averaged 1,782,837 roubles per annum, and if the import through the Asiatic frontier which, for the period between 1887 and 1890, averaged 12,676 pounds worth 347,873 roubles, the total import would reach 2,131,000 roubles; the value of the goods in the second column during the same period averaged 7,644,525 roubles per annum. The figures show that the import of foreign twisted silk, both organzine and tram, sewing silk and combed spun silk, was very considerable. The import increased during the specified periods although the duty was considerably raised.

The import of silk goods was more moderate and is shown by the following table which gives the amount passed through the European frontier.

	SILK AND HALF-SILK STUFFS.		KNITTED AND TRIMMING GOODS.		TOTAL.	
	In thous- ands of pounds.	Paper roubles in thousands	In thous- ands of pounds.	Paper roubles in thousands	In thous- ands of pounds.	Paper roubles in thousands
1877.	2.5	1,465	0.7	162	3.2	1,627
1878.	4.4	2,528	1.5	381	5.9	2,909
1879.	4.5	2,595	1.8	453	6.3	3,048
1880.	4.8	2,797	2.7	649	7.5	3,446
1881.	3.1	1,756	2.3	483	5.4	2,239
			Average . . .		5.7	2,654
1882.	3.2	1,803	1.8	379	5.0	2,187
1883.	3.3	1,857	1.7	337	5.0	2,194
1884.	3.4	1,933	1.6	301	5.0	2,234
1885.	3.4	1,733	1.2	222	4.6	1,955
1886.	2.9	1,353	1.2	236	4.1	1,589
			Average . . .		4.7	2,032
1887.	2.5	1,174	0.9	193	3.4	1,367
1888.	2.2	1,113	1.0	231	3.2	1,344
1889.	3.1	1,527	1.3	294	4.4	1,821
1890.	3.2	1,419	1.5	320	4.7	1,739
1891.	2.5	1,134	1.0	234	3.5	1,368
Average	—	—	—	—	3.8	1,528

Besides the above mentioned goods, wax cloth and oilskin made of silk are also imported, as well as printed foulards, but in very limited quantities. The second period shows a decrease of 18 per cent below the first, and the third a decrease of 20 per cent below the second.

The export from Russia principally consists of cocoons, raw silk, and waste from the process of unwinding. The following table shows the amount exported through the European frontier of late years.

	Cocoons.	Waste.	Raw silk.	Total.	Manufactured silk.
	P O U N D S.				
Average per 1869--1877.	—	—	—	36,466	—
» » 1878--1887.	1,026	4,113	11,289	15,503	47
» » 1888.	—	1,401	968	2,369	13
» » 1889.	—	7,113	787	7,900	14
» » 1890.	255	7,443	3,284	10,756	1
» » 3 years.	95	5,319	1,679	7,008	6

In the total the cocoons have been reduced to raw silk by taking 10 per cent of their weight; the same has been done in the succeeding table. Besides this there is a considerable export through the Asiatic or Transcaucasian frontier, as shown in the next table.

	Cocoons.	Waste.	Raw silk.	Total
	P o u n d s .			
Yearly average 1878—1887	21,184	6,494	3,868	12,480
1888.	6,060	7,038	1,020	8,664
1889	7,712	16,291	3,980	21,042
1890	7,952	12,948	3,474	17,217
Three-year average	7,241	12 092	2,825	15,641

The mean value of the export during the last three years was about 500,000 roubles through the European frontier, and 1,550,000 roubles through the Asiatic. The export of silk stuffs for the period between 1888 and 1890 has averaged about 1,400 pounds per annum, to the value of 554,000 roubles. The total amount therefore is, on the average, about 2,600,000 roubles a year.

On comparing the value of the import, 11,300,000 roubles, with that of the export, it is found that the former is 4.33 times that of the latter; it must however be recollected that the foreign goods are imported principally in the state of raw material, or half-finished, as twisted silk. The import of silk stuffs does not in any case amount to more than 7 or 8 per cent of the value of the native production, and may therefore be considered very small. Notwithstanding the good quality of the Russian silk goods, they come into severe competition with those of Lyons where the silk-weaving industry has attained a remarkable degree of perfection, both from a technical and an artistic point of view, so that the import of fashionable French silks, in spite of the high duties, must be regarded as inevitable.

The following table, compiled from data of the Department of Trade and Manufactures, shows the silk-weaving production, including ribbons, during latter years:

1880.	9,129,000 roubles	1885.	10,193,000 roubles
1881.	10,526,000 »	1886.	12,451,000 »
1882.	11,389,000 »	1887.	12,107,000 »
1883.	10,509,000 »	1888.	13,637,000 »
1884.	10,067,000 »	1889.	13,911,000 »

The production of brocades and galloons, which also should be added to this, in 1889 amounted to 2,060,000 roubles.

These figures cannot however be regarded as being quite accurate as they only show the returns of the large factories, omitting those of many small silk-weaving mills, which if taken together form a considerable item. These small mills are mostly situated in the governments of Moscow and Vladimir and the region near the Vistula, and their production, taken from reliable sources, amounts to about 5 to 7 million roubles per annum, bringing the total production to about 20 million roubles.

The production of silk stuffs is evidently developing gradually, in spite of its dependence upon foreign industry for the necessary material, such as raw and twisted silk. The total number of looms occupied in weaving silk, half-silk and brocade stuffs is 12,449, and 21,898 hands are employed.

The commercial aspect of the silk industry is shown by the annexed table, which gives the price of raw materials and the cost of manufacturing them into goods.

MOSCOW EXCHANGE PRICES IN POUNDS.					
	Milanese.		Bokharan.	Nuhinsk.	Kokhand.
	Warp.	Weft.			
	R O U B L E S.				
1878.	525—575	460—485	205—215	200—210	—
1879.	510—560	—	210—215	200—210	—
1880.	470—530	400—425	218—220	180—190	180—190
1881.	460—525	420—450	180—190	185—195	160—165
1882.	470—540	440—460	190—195	170—180	130—175
1883.	420—485	390—450	200—218	175—180	100—190
1884.	430—510	380—430	200—220	160—185	100—180
1885.	390—430	340—410	170	140—160	190—205
1886.	430—480	420—450	170—185	165—190	140—180
1887.	450—520	425—475	225—250	205—230	225—250
1888.	440—490	430—470	240—245	210—215	240—245
1889.	370—430	370—390	170—175	150—165	185—195
1890.	370—440	370—390	160—175	155—170	180—195
1891.	325—375	290—340	150—170	—	—

In estimating the above mentioned data it is interesting to compare them with the prices of foreign silk, as given in the next table, from statistics of J. Testenoire, Directeur de la Condition Publique, referring to the Lyons silk-weaving industry; the prices are given in paper roubles per pound.

	O R G A N Z I N E.			T R A M.	
	French 1st quality silk ²² / ₂₈ d.	Piedmontese 1st quality silk ²² / ₂₈ d.	Italian 2nd quality silk ²² / ₂₈ d.	Italian 2nd quality silk ²² / ₂₈ d.	Chinese 1st and 2nd ⁴⁰ / ₄₅ d.
1878.	468—480	441—450	396—412	372—384	330—348
1879.	480—510	456—480	432—444	320—432	324—336
1880.	414—426	408—420	372—384	360—372	306—318
1881.	468—480	444—456	360—420	396—402	354—366
1882.	414—426	414—426	390—396	372—384	336—342
1883.	390—396	384—396	348—360	342—354	336—348
1884.	378—390	372—384	336—348	330—342	270—282
1885.	384—390	384—390	354—360	348—360	276—300
1886.	396—402	396—402	372—378	366—372	312—324
1887.	360—372	360—366	342—354	336—348	282—300
1888.	370—362	372—384	342—354	336—348	294—312

By comparing the prices of Italian silk at Moscow and Lyons it is evident that the French silk-weaving trade is able to procure the necessary material at a far lower price.

As regards quality the Russian mills have of late years been manufacturing great varieties of pure silk and half-silk goods, such as faille, satin, surats, satin, bursa, taffetas, moiré, matelassé, damassé, plain and figured velvet, plush, broché, handkerchiefs, coverlets, furniture stuffs, umbrella silks, ribbons, and brocades in various qualities from the cheapest to the most expensive, and in no way inferior to French goods. The smaller mills generally confine themselves to the medium and low quality, cheap goods. In conclusion it may be observed that the quantity of silk produced in Russia is not by any means as large as could be desired. Its further development was much hindered by the necessity of using high price foreign material.

The Government has now raised the duty on twisted silk and taken measures for establishing the silkworm industry, the unwinding of cocoons and silk-throwing business on a more rational basis, so that every hope may be entertained that the Russian silk-weaving trade will, in all its branches, soon attain the same degree of independence, enjoyed by the other native manufacturing industries. If the quantity produced is not at present adequate there is at all events nothing to be said against the quality, as many native silk stuffs are quite equal to those of Lyons and compete successfully with them in the Russian market, and in addition to this, there is one branch of the trade in which Russia is unrivalled, namely the manufacture of brocades, which have attracted great attention at the foreign exhibitions on account of their high artistic merit.

The following table shows the cost of manufacturing certain kinds of silk goods:

DENOMINATION, DIMENSIONS AND WEIGHT OF PIECE.	M A T E R I A L S A N D T H E I R C O S T.		W E I G H T.	WORKING COST PER PIECE.	T O T A L C O S T.	
	W A R P.				Per piece.	Per ar- shine.
					R O U B L E S.	
Faille gros grain 101 arshines by 13 vershoks: 13 lbs. 84 zo- lotniks.	Boiled organzine 6040 threads plain black and 240 double yellow for edges, 6 lbs. and 3 ⁹ / ₁₀ loss: 43 roubles 47 kopecks.	Limp tram, black, triple, 20 throws to 1 centimeter 7 lbs. 84 zolotniks, 8 ⁹ / ₁₀ loss. 32 roubles 61 kopecks.	11.52	17.52	105.12	1.11
L Lyons satin 103 ¹ / ₂ arshines by 13 vershoks. 15 lbs. 12 zo- lotniks.	Boiled organzine 1760 plain black threads 240 double white for edges: 7 lbs 3 ⁹ / ₁₀ loss: 54 roubles 8 kopecks.	Limp tram, black triple, 27 to 1 centimeter 8 lbs. 12 zolotniks 8 ⁹ / ₁₀ loss. 38 roubles 3 kopecks.	15.94	21.61	129.66	1.25
Satin 60 arshines by 26 ver- shoks. 20 lbs. 48 zolotniks.	Organzine 26—28 d. boiled and dyed 5 ¹ / ₂ lbs: 68 roubles 75 kopecks.	Twisted cotton yarn № 40 ¹ / ₂ quadriples 15 lbs. 24 roubles 50 kopecks.	31.95	25.04	150.24	2.50
Plush 31 ¹ / ₂ arshines. 10 lbs. 44 zolotniks.	Organzine 38 d. for nap, 4 lbs. 86 zolotn. twisted cotton. Yarn for body № 60 ¹ / ₂ 1 lb. 64 zol: 53 roubles.	Twisted cotton yarn № 40 ¹ / ₂ 3 lbs. 86 zol. 2 roubles 76 kopecks.	36.65	18.48	110.90	3.52
Brocatel 50 arshines by 26 vershoks. 37 lbs. 53 zolotniks.	Organzine 24—26 d. Gendarme colour: 6 lbs. 83 zol. 86 roubles 90 kopecks.	Limp tram two coloured 7 lbs. 5 zol. Flax yarn № 14. 23 lbs. 61 zol. 52 roubles 88 kopecks.	65.85	43.69	216.12	5.24

CHAPTER V.

Paper Industry

IN early times in Russia parchment was used for writing purposes, but as this material was expensive other cheaper substitutes were tried, such as bast and birch bark, particularly the latter. Writing paper made its appearance from the east in the fourteenth century; it was made of cotton. The Tartar and Kalmuck charters, and also the most ancient book, date 1371, were written on this kind of paper. The manufacture of paper dates from the time of Ivan the Terrible, when one paper mill was built. During the reign of Alexis Michailovich there were already two, but the paper produced was of inferior quality, and therefore foreign paper was still in vogue.

Peter the Great placed the paper-making industry on a firmer footing. Experienced paper makers were invited from abroad; a Government paper mill was built in Moscow and young men were sent to other countries to study the industry. When the capital was transferred to St. Petersburg a second Government mill was built in the vicinity, called the Doudourovsk Manufactory; a decree was issued for rag-collecting and the price was fixed at 8 half-kopeks per pound. After the death of Peter the Great there were but four paper mills, but this number was gradually increased. During the reign of Anna Ioannovna a mill was built at Krasnoe Selo for supplying the Government offices with stamped paper. The Empress Catherine II decreed that all law courts were to use in preference paper of Russian manufacture; this considerably assisted the development of the paper-making trade, and the number of mills rapidly increased. In 1765 there were 13 mills; in 1766 there were 23, and in 1780 there were 25, producing 150,000 roubles worth of paper. At the beginning of this century the number further increased to 64. In 1812 the Tsarskoe Selo mill was superseded by the Imperial State Paper Manufactory, established in St. Petersburg. In 1814 the number of mills rose to 74. The technical progress achieved was however small in spite of the increasing number of mills; the change from hand-made to machine-made paper, which created a thorough revolution in the paper-making trade, was already

introduced in Western Europe at the commencement of the present century, but only penetrated into Russia after 1815.

The Emperor Alexander I. being desirous of introducing the latest improvements of the trade into Russia, ordered a mill to be built which might serve as a model for others. This led to the establishment of the Imperial Peterhov Paper Manufactory in 1817, and the first continuous paper-making machines were used there, instead of the hand process. The first results were however disastrous both from a technical, and more especially from a commercial point of view, on account of the mismanagement and extravagance of the foreign director, Mr. Westinghausen. The mill was therefore given over to the Crown, and Kazin was appointed director. The aspect of affairs soon changed, and during the six subsequent years 1,230,000 roubles clear profit were realised, and the paper was of high quality. The design of the Government in establishing this mill was not only to make it a model for other manufacturers, but also to check the sale of foreign paper in Russia, and to sell paper abroad. Unfortunately the price of the Peterhov paper, in spite of its good quality, was high, and out of the reach of most consumers. This fact, combined with the development of the private mills, led to the closing of the Peterhov Manufactory in 1849. The progress of civilization and the efforts of the Government led to continued increase in the number of private mills, and from 1816 to 1841 the import of writing paper from abroad was forbidden. The tariff of 1841, although it again permitted the import of paper, named the almost prohibitive duty of 55 kopecks per pound. The tariffs of 1850 and 1857 reduced the duty to 5 roubles per pound.

The greater number of the mills adhered to their former processes of manufacture, and but few of them adopted any improved methods, some however began to use the horizontal continuous paper-making machines. Gagarin in the Government of Yaroslav, and Menschikov and Ousatchev in Moscow, introduced this important improvement in 1837, and the success and commercial advantages of this important innovation were soon felt and appreciated by most paper makers. In 1850, out of the 159 mills producing 3,225,000 roubles worth of paper, 29 were using continuous paper-making machines and producing 2,000,000 roubles worth of paper, or about 62 per cent of the total amount.

The following figures will convey some idea of the progress of the Russian paper-making industry from its commencement until 1884. This table clearly shows that under the influence of the measures taken by Peter the Great and kept up during the subsequent reigns, and also in consequence of the advance of civilization, the number of paper mills gradually increased and especially developed between 1830 and 1862, on account of the introduction of paper-making machines which superseded the old manual process. During this space of thirty-two years the production increased nearly 60 per cent, but after 1862, judging from the number of mills, it began to decline. After 1850 the production of the mills, given in roubles, is stated, and this is more reliable than the number of mills. The history of paper making is similar to that of many other branches of industry, the progressive improvement of machinery is the same, more efficient and more productive methods are adopted, requiring the expenditure of large sums of money, and therefore necessitating considerable working capital. This is not within the reach of all mill owners, and many

PERIOD.	NUMBER OF MILLS.	YEARLY PRO- DUCTION IN ROUBLES.	NUMBER OF HANDS.
Ivan the Terrible	1	—	—
Alexis Michailovich	2	—	—
Peter I	4	—	—
1765	13	—	—
1766	23	150,000	—
1804	61	—	—
1820	87	—	—
1830	104	—	—
1850	159	3,225,000	—
1856	161	3,661,314	—
1862	165	5,682,172	12,280
1870	137	6,095,303	—
1879	126	9,568,000	10,890
1880	136	10,876,000	11,510
1881	139	13,677,000	11,719
1882	134	12,451,000	12,239
1883	131	14,217,000	12,358
1884	140	14,697,000	13,304

are compelled to close their mills, while the production of the others, who have been able to improve their mills, rapidly increases. In tracing the development of the trade from 1862 to 1883 it is noticeable that the number of mills gradually decreased from 165 to 131, but during the same period the production rose from 5,333,333 to 14,200,000 roubles. In general the progress of the paper-making trade was systematic, even uninterrupted and comparatively rapid, thanks to the protective duties.

The price of paper varies from 3 to 16 roubles per pound. At present the usual prices are: wrapping paper, 3 roubles per pound; unbleached writing paper, 6.61 roubles; the same half-bleached, 7.25 roubles; the same bleached, about 8.50; bleached and glazed, about 9.25 roubles; the vergé, 11 to 14 roubles. At these prices a duty of 3.95 roubles in gold, or about 6 roubles paper money, is practically prohibitive for the medium and lower qualities, so that the higher qualities alone are imported.

The above data refer to paper mills producing various kinds of paper; the other goods manufactured in special mills, and also their production, are enumerated in the next table.

	NUMBER OF MILLS.	ANNUAL PRO- DUCTION IN ROUBLES.	NUMBER OF HANDS.
Wall paper factories			
In 1879.	25	1,086,000	1,163
» 1884.	27	1,216,000	1,209
Various paper wares			
In 1879.	28	2,270,000	1,263
» 1884.	44	2,602,000	1,817
Wood-pulp mills			
In 1879.	7	200,000	93
» 1884.	26	603,000	391

In addition to this the following data are appended which refer to the paper-making trade in Poland.

	NUMBER OF MILLS.	YEARLY PRO- DUCTION IN ROUBLES.	NUMBER OF HANDS.
Paper mills			
In 1879.	37	1,036,000	1,076
» 1884.	27	1,919,000	1,891
Wall papers and coloured ditto			
In 1879.	6	143,200	182
» 1884.	4	190,000	232
Various wares made of paper			
In 1879.	4	110,000	85
» 1884.	4	48,000	65

These tables show that in Russia, exclusive of Finland, there were in 1884. 167 regular paper mills manufacturing paper and cardboard of various kinds; these mills employed 15,195 hands, contained 135 paper-making machines and had an annual production of 16,616,000 roubles. If the wall-paper mills and the factories of miscellaneous paper goods be added, the total number amounts to 270, employing 18,909 hands with a yearly production of 21,275,000 roubles. If the export and import of paper be compared to these figures it is found that in 1884 the import of 2,135,435 roubles is about 10·26 per cent, and the export of 165,361 amounts to 0·79 per cent of the internal production.

During 1885 and the subsequent years the paper trade with some few fluctuations continued to increase, and is shown by the following figures, which in 1888 include the production of Finland, no other yearly returns of the industry of that country being available.

	PERIOD.	NUMBER OF MILLS.	YEARLY PRO- DUCTION IN ROUBLES.	NUMBER OF HANDS.
Russia in Europe and Poland	1885	164	16,365,000	15,958
	1886	157	15,817,000	15,838
	1887	152	16,501,000	15,478
European and Asiatic Russia.	1888	155	16,849,000	16,263
Finland	»	9	2,957,000	1,721
European and Asiatic Russia.	1889	161	17,908,000	17,402

These figures show that the annual production, which in 1885 amounted to 16,333,333 roubles, gradually increased, until in 1889 it almost reached 18,000,000 roubles, or 20,000,000 together with Finland. The number of mills decreases as the total production increases; in 1885 there were 164; in 1887 this figure decreased to 152 but afterwards again rose to 161 in 1888.

The wall paper trade also made progress during the same period, although experiencing some considerable fluctuations.

	PERIOD.	NUMBER OF MILLS.	YEARLY PRO- DUCTION IN ROUBLES.	NUMBER OF HANDS.
Wall paper trade in Russia in Europe and Poland.	1885	22	1,219,000	1,292
	1886	26	1,163,000	1,347
	1887	30	1,776,000	1,288
Russia in Europe, Asia and Poland	1888	25	1,519,000	1,249
Finland	1888	2	100,000	40
Russia in Europe, Asia and Poland.	1889	20	1,426,000	1,106

A considerable decrease in the number of workmen is here observed; in 1885 there were 1,292 hands employed, and in 1889 only 1,106, with an increased production: this is accounted for by the more general use of machinery of a more improved type.

The application of paper, cardboard and paper pulp for manufacturing various goods has not attained that degree of importance or variety in Russia that the industry has reached in other countries, especially in America, as in this country papier-maché goods, cardboard boxes et cetera, are not so much made in factories as in the villages and with hand tools, so that they are much cheaper and in greater variety. The extent of this branch of trade is shown by the following figures.

	YEARS.	NUMBER OF MILLS.	YEARLY PRO- DUCTION.	NUMBER OF HANDS.
European Russia . . .	1885	45	2,699,000	1,872
" " . . .	1886	57	2,733,000	2,410
" " . . .	1887	58	2,749,000	2,720
" " . . .	1888	67	2,234,000	2,713
In Finland	»	70	128,000	288
European Russia . . .	1889	70	2,278,000	5,769

Workshops for book-binding are only included in the returns for Finland as in the other parts of Russia they belong to a separate guild.

These figures show that in 1885 there were 45 factories engaged in manufacturing various goods from paper, employing 1,872 hands, with a production of 2,700,000 roubles; in the subsequent years the number of factories rapidly rose to 70 in 1889, but the production did not correspond in the least to this increase in the number of manufactories; it first slightly rose until 1887 and then began to decline, falling to 2,300,000 roubles in 1889, that is, 400,000 roubles less than in 1885. This is partly due to the fact that the village industries, being assisted by the local authorities especially in the government of Moscow, furnished the market with cardboard goods cheaper than the factories, and because the latter alone were registered. A review of the yearly production shows that it increased very slowly but constantly, from 20 to 22 million roubles.

If the manufacture of wood pulp be included, the foregoing statistics of the Russian paper trade will show a further increase of 20 mills in Russia and 12 in Finland with an annual production of 697,000 roubles in Russia and 912,000 in Finland employing respectively 436 and 743 hands, so that the total returns of the Russian paper trade for 1889 will be 364 mills, employing 30 thousand hands and producing nearly 26 million roubles. The production of each mill has risen steadily since 1870. In that year the average production of 137 paper mills was 44,500 roubles; in 1879 the average of 126 paper mills was about 76,000 roubles; in 1889 the number of paper mills in European Russia rose to 208, with an average production of about 88,000 roubles.

Most of the paper mills are engaged in the manufacture of wrapping paper, paper for bags, white, gray and blue, blue packing paper, sugar and bottle paper.

The production of writing, printing, post and newspaper is more limited. Some special mills manufacture the following varieties: prescription paper for chemists, in many colours, tickets, book, telegraph, high class writing papers, so-called royal, ministerial, vellum, also cigarette paper, photographic and drawing paper, elephant, royal, Alexandrian and others.

The price of paper, according to its quality, weight, whiteness and finish, varies greatly. One pound of writing paper of the various kinds, except the very high qualities, such as royal and ministerial, Nos. 1 to 8, costs at the mill about 4.60 to 10 roubles, and printing paper from 4 to 6 roubles per pound.

Almost all Russian paper is sized with vegetable or rosin size, animal size being only used in the Imperial State Paper Manufactory, and a very few private mills, for some special kinds of paper for executing special orders. The Troitzk-Kondyrevsk mill and that of Vargounine Bros. use it for making the paper for card manufacture. Vegetable parchment is made at Pallisen's mill in the government of St-Petersburg, at Polivanov's in the government of Moscow, and at other mills.

After this preliminary survey, the paper and cardboard industry in particular should be studied. For the sake of convenience it may be divided into five districts. The first comprises the Baltic provinces; the second deals with the governments of Great Russia with the more highly developed production of the governments of Kalouga, Vladimir, Tver, Moscow Yaroslav and Penza. The third district includes the southern and south-western governments with the more considerable production of the governments of Volhynia and Kiev. The fourth group is made up of the western governments, that of Moghiliév ranking first. The fifth district comprises the governments of Poland. Out of a total of 42 governments possessing paper mills only those having a minimum production of 400,000 roubles are enumerated.

The first district leads not only in its production but also in the number of well arranged mills which it contains. The 18 paper mills in the government of St-Petersburg have 52 steam boilers, 40 steam engines with a total of 2,035 horse power and 30 turbines of 800 total horse power. They produce cardboard and paper to the value of 3,830,000 roubles, and employ 2,238 men.

The Imperial State Paper manufactory ranks first among the St-Petersburg mills and is remarkable for the excellence of its product. But as it not only manufactures paper of the highest qualities for bank notes, stamps, envelopes, deeds, bills of exchange et cetera, which are also engraved and printed in the establishment, but makes all the Government paper, it cannot be classed as a commercial undertaking and is therefore merely mentioned here, especially as its description and exhibits appear at the Columbian Exhibition at Chicago.

The paper mill of Vargounine Bros. near St-Petersburg, is one of the best; it was founded in 1840 and is called the Nevsky Mill. In 1878 it manufactured paper on three continuous paper machines to the value of 812,000 roubles. In 1889 its production further increased to 927,000 roubles and employed 367 hands. In 1891 the mill was altered and enlarged; a fourth paper-making machine was added and the number of hands increased to 560; the total horse power was 800, and the mill was capable of producing 200,000 poods, that, is 3,233 tons of paper to the value of 1,500,000 roubles. The mill has its own chapel, hospital, school for 60 children, reading room, sewing class, lodging house for 500 men and a store.

M. Pallisen founded his mill in 1881; in 1886 it was turned into a Joint Stock Company; a separate section was arranged for cellulose and shortly before 1890 the production amounted to 300,000 roubles. In 1890 and 1891 a second and a third paper-making machine were added. At present this mill has 3 steam boilers, 6 steam engines and a plant sufficient to manufacture 250,000 pounds of paper worth 1,120,000 roubles. The cellulose department has been removed to Oust-Ighora, 25,000 versts from Petersburg; it manufactures cellulose by the sulphide process and is capable of producing 130,000 pounds to the value of 380,000 roubles. This establishment has organized a savings bank which receives funds of the mill as well as from the work people. The mill hands are insured against accidents.

The Golodaev Paper Manufactory was established by M. Krylov in 1882; it produces printing paper to the value of 340,000 roubles. In 1888 it became the property of M. Basil Pechatkin, a mechanical engineer who almost entirely rearranged it; new machines were put up and more perfect processes introduced. The mill now contains 6 steam engines with a total of 460 horse power; there are two paper-making machines producing 150,000 pounds of paper to the value of 750,000 roubles, and 250 hands are regularly employed. The principal kinds of paper manufactured are the following: printing, elephant, vellum, newspaper and all kinds of ticket and album papers.

The following are some of the principal paper mills in the districts of the government of St-Petersburg: M. C. Pechatkin's mill at Krasnoe Selo, established over 100 years ago. The motive power of this mill is made up of two 30 horse turbines and 6 steam engines giving 175 horse power; 141 men are employed. There are four paper-making machines producing 41,000 pounds of foolscap, writing, newspaper and cardboard, 15,000 pounds of paper in rolls and 350,000 reels of telegraph tape. The yearly production amounts to 280,000 roubles. Messrs. C. & H. Nebe's paper mill was founded in 1839; it has two steam engines giving 155 horse power and 5 turbines yielding 335 horse power; there are two paper-making and one cardboard-making machine; 254 hands are employed and 97,500 pounds of writing paper, foolscap paper and cardboard are manufactured. The value of the annual production is 608,000 roubles. There is a school attached to this mill. Mr. C. Lindgart's mill was established in 1810. There are three steam engines with a total of 94 horse power. 70,600 pounds of writing paper, printing, alumen and wrapping paper are made; 160 men are employed and the yearly production amounts to 445,000 roubles.

There are 9 paper mills in Livonia having 11 turbines with an aggregate of 400 horse power, 16 steam boilers and 12 steam engines yielding 560 horse power. They produce paper and board to the value of 1,087,000 roubles and employ 606 men. The principal mill belongs to the Riga Paper Mill Ligat Company. It was established in 1864 and has 4 steam engines, makes 68,000 pounds of paper of various kinds selling at from 3.60 to 16 roubles per pound, the yearly production being 470,000 roubles, and 250 men are employed.

In the government of Novgorod there are 5 paper mills with 9 turbines giving 565 horse power, 17 steam boilers and 10 steam engines yielding 772 horse power and 748 hands are employed. The yearly production amounts to 685,000 roubles. The principal mill belongs to Mr. Pasburg and was established in 1863. It has only one steam engine; it manufactures 150,000 pounds of wrapping paper to the value of

250,000 roubles and employs 450 hands. There is a school and also a hospital attached to this mill.

Among the governments composing the second paper making district, that of Kalouga is the most important. It contains nine mills, the motive power being generated by 11 turbines yielding 400 horse power and 19 steam engines giving 560 horse power fed by 16 boilers. The yearly production is 1,568,000 roubles and 1,639 hands are employed. The principal mills may be described as follows: Mr. Howard's Troitsk-Konrovsk paper mill, founded in 1790 by Mr. Schepochkin in the village of Kondrova on a very large scale. The business then passed into the hands of Mr. Howard who developed it to such an extent that in 1858 there were three mills in the villages of Kondrova and Troitska. Mr. Howard then turned the affair into a Stock Company. The enterprise developed with such rapid strides that from 1880 up to the present time the average yearly production has been about 1,500,000 roubles. These mills use cellulose of their own manufacture. Various qualities of paper are made, but the principal item is 800,000 roubles worth of writing paper. There are four paper-making machines and 15 steam engines, yielding 1,200 horse power and 2 water wheels of 30 horse power. There are two village schools, one technical school and a hospital attached to the establishment.

The seven paper mills of the government of Vladimir have 15 steam boilers and 10 steam engines generating 292 horse power. The yearly production amounts to 876,000 roubles and 719 hands are employed. The principal mills are that of Protasiev founded in 1861 containing 3 steam engines of 80 horse power, producing 60,000 pounds of writing and newspaper valued at 352,000 roubles; 315 men are employed, a school and hospital being attached to the mill; Sposobin's mill, founded in 1814, containing 2 steam engines of 40 horse power, producing 70,000 pounds of writing and other kinds of paper, valued at 420,000 roubles, and employing 252 men.

In the government of Tver there are five paper mills with 5 hydraulic motors of 110 horse power, 21 steam boilers and 13 steam engines generating 684 horse power. The total production is 998,000 roubles and 1,018 hands are employed. The government of Moscow contains 16 mills having altogether 13 steam boilers and 11 steam engines giving 162 horse power. The yearly production is 472,000 roubles and the number of workmen 727. The principal mill is Mr. M. Polivanov's Writing Paper and Vegetable Parchment Company, established in 1874. It has two steam engines of 45 horse power, manufactures 50,000 reams of paper and 2,265 pounds of parchment; the total production is valued at 232,000 roubles, the number of hands being 250. The two mills in the government of Yaroslav have together 4 steam boilers and 10 steam engines with an aggregate of 234 horse power. The value of the yearly production averages 449,000 roubles and 491 men are regularly employed. The largest mill belongs to the Ouglitch Writing Paper Manufacturing Company, founded in 1735; the plant includes 7 steam engines yielding 182 horse power. The yearly production amounts to 74,500 pounds of printing, writing, wrapping paper and cardboard; the value of this output is 410,000 roubles; 368 men are employed. The two mills in the government of Pensa are supplied with motive power by 7 hydraulic motors generating 412 horse power, 5 steam boilers and 6 steam engines giving 80 horse power. The yearly production is 528,000 roubles and the number of hands 640. The best mill, founded in 1850, is owned by Sergeyev & Co., who manufacture 135,000 pounds

of writing and other paper per annum, to the value of 670,000 roubles, the number of hands being 864.

Among the mills in the government comprised in the third, or southern group, the following may be mentioned: nine paper mills in Volhynia having 16 hydraulic motors generating 280 horse power, 17 steam boilers, 16 steam engines giving altogether 505 horse power, 589 hands employed, yearly production 563,000 roubles; three mills in the government of Kiev with 12 steam boilers and 13 steam engines supplying 400 horse power; their yearly production amounts to 541,000 roubles in value. In consequence of the large trade done in beet sugar very many small mills make only sugar paper.

In the government of Mogilev belonging to the fourth, or western group, there are three paper mills; these are supplied with power from 4 hydraulic motors generating 420 horse power, 7 steam engines furnishing 464 horse power being in use; their yearly production is worth about 918,000 rouble. The most considerable mill belongs to the Dobroushsk Company, established in 1871 by Prince Pashkevich; shortly before 1880 this mill produced wrapping and cheap writing and printing paper to the value of 250,000 roubles. In 1878 the business was turned into the hands of a Stock Company, and under the management of the mechanical engineer, Mr. Stoulchinsky. The mill was in a short space of time much altered and enlarged: 2 new turbines of 350 horse power and 2 steam engines yielding 500 horse power were put up, and all the paper-making plant was much improved. Many notable additions were also made, such as a fitting and repairing shop, a mill capable of manufacturing 160,000 pounds of straw stuff, a wood-pulp mill, caustic soda and alkali works and a railway branch line, four and one-half versts long, with rolling stock. The mill is lighted by electricity and the production increased to 195,000 pounds of writing, printing, telegraph and other paper to the value of 980,000 roubles; 550 hands, including 200 women are employed. There are an apothecary shop, doctor, surgeon, school, general store, savings bank and pension fund attached to this establishment.

The fifth group is made up of the governments of Poland, that of Warsaw being far the most important. Four of the mills in this government have 6 hydraulic motors, 8 steam boilers and 6 steam engines giving 268 horse power; their yearly production amounts to 930,000 rouble, and they employ 1,252 men. One of the largest mills belongs to the Soshevka Paper-making Company; its motive power consists of 4 hydraulic motors and 3 steam engines, supplying altogether 396 horse power; it manufactures writing and wrapping paper, and cardboard to the value of 470,000 roubles per annum and employs 500 men. The ten paper mills in the government of Petrokov are driven by 5 hydraulic motors generating 99 horse power, 15 steam boilers and 14 steam engines furnishing 312 horse power. Their total production has a value of about 744,000 roubles, and 568 men are employed. There are two paper manufactories in the government of Kelets supplied by 3 hydraulic motors generating 115 horse power, 6 steam boilers and 4 steam engines of 130 horse power in all. Their yearly production is about 430,000 roubles and 400 men are employed. There are also two paper mills in the government of Kalish, driven by 3 turbines generating 122 horse power, 4 boilers and 5 steam engines whose united horse power is about 185. Their total production has a value of 421,000 r., and they employ 410 men.

Having briefly described the paper and cardboard manufactories, the wall paper trade, which is more or less centred in the governments of Poland, St. Petersburg and Moscow, may be next considered.

In the government of St.-Petersburg there are six mills occupied in manufacturing wall paper; their motive power is derived from 5 steam boilers and 5 steam engines producing 48 horse power. Their yearly production has a value of 708,000 roubles, and they employ 417 hands. The principal mills are that of by Camuset & Co., established in 1841, and which has one 10 horse power steam engine and manufactures 435,000 pieces costing 104,000 roubles, 100 men being regularly employed; and that of the Onkonine Wall-paper Manufacturing Co., at Tsarskoe Selo, acquired from the government in 1858, driven by one 12 horse power engine, yearly production being valued at 145,000 roubles, with 111 hands.

Nine mills in the government of Moscow have altogether 4 steam boilers and 3 steam engines with 71 total horse power: their united yearly production is valued at about 494,000 roubles, there being 557 men engaged in the trade. The largest factory belongs to Mr. Krotov, founded in 1868; it is driven by one 16 horse engine and manufactures 10,000 pieces per day, the yearly production reaches 240,000 roubles and 200 hands are employed.

In Poland there are three mills carrying on the manufacture of wall-papers to the yearly value of 178,000 roubles and giving work to 94 men; their plant includes 2 steam boilers and two 20 horse power steam engines. There are also many factories where the manufacture of divers objects made of paper is carried on, but they are principally situated in the governments of Moscow and St.-Petersburg. In the former district there are 16 of these mills, one of which possesses a steam boiler and one 8 horse power steam engine. The total yearly production of these mills is 862,000 roubles and 2,611 men are engaged therein. The largest mill belongs to Mr. A. Victorson and was established in 1873; it manufactures 350 million cigarette tubes worth 120,000 roubles, and employs only 15 men.

In the government of St.-Petersburg there are 17 of these factories, having altogether 5 steam boilers and 4 steam engines yielding 65 horse power; they employ 1,477 hands and their yearly production is valued at 772,000 roubles. The largest of these mills is owned by the Foundling Hospital and Institute, under the patronage of the Imperial Family. This establishment possesses the exclusive privilege of manufacturing playing cards, all the profits being devoted to the education of destitute orphan children. The mill is driven by two 55 horse power steam engines and the plant comprises 15 platen printing presses and 11 glasing rolls. The yearly production is 400,000 dozen packs of playing cards valued at 1,680,000 roubles, and employing 314 men. The balance sheets of this establishment quote the working expenses at 374,000 roubles per annum.

IMPORT OF PAPER.

In spite of the development of the Russian paper-making trade, it is not yet in a position to supply the home demand as the import of foreign paper still continues to increase. From 1870 to 1880 the importation of paper has increased from

899,074 to 2,065,796 roubles, as shown by the following table giving the amounts passed through the European frontier.

V A L U E O F P A P E R I M P O R T E D.			
Y E A R S.	Roubles.	Y E A R S.	Roubles.
1870	899,047	1876	2,412,385
1871	1,200,736	1877	1,080,450
1872	1,686,805	1878	1,751,863
1873	1,938,350	1879	1,846,947
1874	2,117,171	1880	2,065,796
1875	2,539,921		

Since 1880 the import has continued in general to increase but exhibits some considerable fluctuations; thus, in 1884 the amount passed through the European frontier was valued at 2,135,435 roubles; in 1885 it rose to 5,087,544; in 1886 it declined to 2,570,106 roubles; the average for the three years was 3,271,028 roubles. The great increase in 1885 was due to sudden import of paper through the frontier of Finland to the amount of 2,900,000 roubles, whilst during the preceding years hardly any paper had been imported from Finland and in 1886 this item declined 72 per cent.

The next table shows the value of the import of paper for the subsequent years, and as in the previous table; the figures refer to the import through the western frontiers, including the border line between Finland and the other parts of the Russian Empire, as a great deal of paper comes to St. Petersburg from the Grand Duchy; the import of books, and prints is included.

VARIETIES AND VALUE OF PAPER IMPORTED.	1887.	1888.	1889	1890.
	Roubles.	Roubles.	Roubles.	Roubles.
Paper	1,937,721	1,711,364	2,238,026	2,161,480
Cardboard	134,734	155,209	214,667	216,322
Books	1,659,794	1,645,892	1,771,276	1,755,060
Pictures and hand drawings . .	286,457	183,893	235,226	157,868
Prints, engravings	113,796	276,718	146,796	127,957
Maps, music	110,410	136,847	137,560	128,845
Wall papers and borders . . .	118,948	87,816	102,693	95,649
Wood pulp and papier maché .	1,027,634	1,197,965	1,530,220	2,017,737
Paper cuttings and rags . . .	330,696	540,204	220,889	150,404
Total . . .	5,718,190	5,935,908	6,580,393	6,811,328

The first of these items is the largest, its average for the four years being valued at 2,024,295 roubles; it may be subdivided as follows: *a.* sized paper of different qualities, average for the four years, 1,022,733 roubles; *b.* unsized white and coloured paper without ornamentation, yearly average, 66,965 roubles; *c.* printing and other paper, 155,272 roubles; *d.* cigarette, chinese, wrapping and other paper, mean yearly average value, 767,176 roubles. The item entered as books, is considerable and fairly constant, being on the average worth 1,708,005 roubles; it may be subdivided into four categories as follows: *a.* books printed in foreign languages, average value of import, 1,622,730 roubles; *b.* books printed abroad in the Russian language and unbound, yearly average value of import, 6,443 roubles; *c.* the same bound, 2,898 roubles; *d.* ledgers and copy books, 75,434 roubles.

Wood pulp is imported in large quantities, and although this item fluctuates considerably, it is greatly increasing; in 1887 it was set down at 1,027,634 roubles, and in 1890 it rose to 2,017,735 roubles, or almost doubled in the space of four years, the average being 1,443,389 roubles, or about 22.5 per cent of the total import. This industry may be divided into two classes: *a.* wood pulp pressed into sheets, having the appearance of cardboard, and papier maché, average value, 623,301 roubles; the greater part of this comes from Finland which supplies on the average 599,011 roubles worth, or about 96 per cent of the whole quantity; *b.* wood pulp in any other form than sheets, and all other kinds of paper stuff or pulp, yearly average value, 802,087 roubles, Finland supplying to the amount of 633,200 roubles or about 78.75 per cent.

EXPORT OF PAPER GOODS.

These exports are various and may be classed as follows: 1. paper; 2. cardboard; 3. books; 4. free-hand drawings and plans; 5. prints and engravings; 6. pictures; 7. papier maché; 8. paper cuttings; 9. rags.

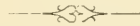
VARIETIES OF PAPER EXPORTED.	1887.	1888.	1889.	1890.
	Roubles.	Roubles.	Roubles.	Roubles.
Paper	167,678	156,803	180,368	180,122
Cardboard	21,171	22,886	13,004	4,630
Books	605,373	506,452	574,420	548,635
Plans and drawings.	1,869	2,447	4,768	3,867
Prints and engravings.	9,194	14,638	23,032	6,597
Pictures	142,320	359,641	158,650	152,683
Papier maché.	3,218	6,861	3,979	1,336
Paper cuttings	29,280	4,008	9,123	3,287
Rags	855,487	758,904	619,466	452,776
Total . . .	1,835,590	1,832,639	1,587,810	1,353,933

The above-mentioned data show that the export is small and averages 1,652,493 roubles worth per annum during the four years enumerated. A decrease is exhibited especially with regard to rags, the export of which has declined from 855,487 roubles in 1887 to 452,776 roubles in 1890, due to an increased consumption at home, to the existence of an export duty of 30 copecks per pound, and also to the temporary restriction on export from sanitary reasons. The next most important item is that of books the mean export for the four years being valued at 558,720 roubles or about 34 per cent of the whole. The average export of pictures during the stated period is 203,323 roubles or 12 per cent of the total export. The mean value of the paper exported during the period of four years is 171,242 roubles or 10 per cent of the sum total.

In conclusion, the various data which have been quoted in connection with the paper-making trade in Russia up to the commencement of 1890 may be condensed into the following figures which show the state of this industry at present:

Russia, except Finland, in 1889:

Paper mills.	271	
Hands employed	24,710	
Total value of production.	22,500,000	roubles
Average value of production.	83,059	»
Value of labour per man	901.9	»
Import	4,250 000	»
Export	500,000	»
Home consumption	26,000,000	»
Home consumption per head counting		
120,000,000 inhabitants	0.22	»



CHAPTER VI.

Leather Goods.

TANNING is one of the oldest branches of Russian industry and originated in the East, spreading thence throughout the Empire. Russian curriers are already mentioned in the ancient chronicles of Nestor. Later on the tanning trade developed to such an extent that a tax was levied upon those who practised it during the reigns of Dimitri Donskoi, Basil Dimitrievich and Basil the Dark. Kazan has, from time immemorial, been the centre of this industry in eastern Russia.

When Kazan passed into the hands of the Tartars this trade still further developed on account of the great demand for morocco and other leathern goods. When the town was conquered by Ivan the Terrible the tanning trade was for a time held in check, but soon afterwards became brisker and quickly recovered itself and with greater energy than ever, established itself in the governments of Nizhni-Novgorod, Kostroma, Yaroslav, Novgorod and Pskov. The most well known product was Russia leather which has for ages been exported and sold in bales of one to one and one-half poods. During the latter half of the seventeenth century about 75,000 bales were exported from Kholmogora and Archangel. In the towns of Totma and Vologda during the winter the leather goods were stored in large warehouses ready for shipment abroad in spring. The Government took measures for fostering and developing the industry and in the reign of Peter the Great a number of decrees were issued tending to improve the manufacturing processes; curriers were engaged in foreign countries and brought over to teach the various kinds of leather dressing; numerous regulations were prescribed, and in 1716 a large Government order of 100,000 pounds of Russia leather at 4 roubles per pound was given to private firms to be delivered in Archangel, where the hides were sold by the state without profit. Up to the accession of Catherine II there were 25 tanneries and 10 leather dressing works in Russia and at the end of her reign the number of tanneries had increased to 84.

The export of hides was considerable and the amount at the end of the last century was as follows:

TOTAL AMOUNT OF LEATHER.	1778—1780	1790—1792
	R O U B L E S.	
Goods	1,049,642	1,493,354
Russia leather	1,010,288	1,258,106
Other dressed hides	33,713	228,521
Pelts	6,641	6,727

Russia leather was evidently the most important item of export, and pelts the most insignificant. The wars at the commencement of the present century created a great demand for boots and other leathern goods and enormously increased the production of the leather factories. In 1804 there were 850 tanneries employing 6,304 hands, and in 1814 the number had increased to 1,530 with 7,799 hands.

The quality of the goods did not however improve with the increased production nor keep pace with the progress made abroad in this branch of industry, therefore the export soon began to decline, as shown by the accompanying figures, which give the amount passed through the European frontier in roubles.

	1814—1815	1820—1821.	1824—1826.
Total leather export.	1,472,196	813,183	704,460
Russia leather	1,271,845	785,392	641,001
Other hides	201,351	27,791	63,459

The decrease in the export of dressed hides occasioned an increased export of pelts as shown by the following figures:

1802—1804	81,751 roubles
1814—1815	149,823 »
1824	631,686 »

The import of leathern goods was very small and averaged about 90,000 roubles. In course of time the demand for such goods still further increased, and in 1835 there were already 1,862 tanneries; in 1850 the number rose to 2,063, employing 10,383 men with a production of 8,500,277 roubles. The greater part of this quantity was, however, the produce of small tanneries, the owners of which possess neither sufficient knowledge nor capital to improve their methods or increase their production. These defects were most apparent in the manufacture of boot soles, and partly depended upon the small necessities of the consumers and partly upon the demand for cheap goods.

The introduction of more rapid tanning processes and of other improvements in the trade, the increased competition and the import of foreign goods and likewise

the increased wants of the Commissary Department which was the largest orderer of shoe leather and other leather goods, and also the growing demand for imported straps, combined to give an impetus to the various processes of the tanning trade in Russia. More large tanneries were established; the dressing of thick boot sole leather and belting began to develop and improve, and at the same time created a demand for thick American raw hides. Most of the largest tanneries were established at about this time, namely, Brousnytzen's in 1847, Ossipov's in 1857, the Vladimir Tanning Co. in St. Petersburg in 1862, Shlenker's in 1846, and Pfeiffer's in 1854, the two latter, in Warsaw. Some of the old tanneries were enlarged and improved: Zverkov's of St. Petersburg in 1832, Shouvalov's in 1830, and Bakhronshin's in 1834, both in Moscow. Temler and Schwede's in 1819 in Warsaw, and many others. Although improvements in the trade proceed very slowly, compared with those made in other branches of industry, still a great deal of progress was made manifest at the Russian Exhibitions of 1861 and 1870, at the former there were 48 exhibitors and a very complete and various collection of leather goods was shown, some exhibits being of very high class goods. There were 60 exhibits at the Exhibition of 1870, besides half-tanned hides, Russia leather, calf leather, dressed calfskins, and morocco; some excellent samples of heavy shoe leather and belting were shown. The mechanical tanning processes and other improvements have however spread very slowly, and have only been adopted at comparatively few tanneries. The leather trade greatly extended during the period last mentioned and its production is shown by the following figures:

YEAR.	Number of tanneries.	Yearly pro- duction in roubles.	Number of hands.
1856	2,074	9,959,996	11,739
1860	3,410	16,752,427	13,489
1864	2,462	17,750,042	12,927
1868	2,860	16,865,242	13,742
1870	2,899	24,991,617	14,880

At that time the duty on imported leather was 10 roubles per large dressed hide and 4 roubles per small; the import, although, continued to increase, the mean being as follows:

D A T E.	Small hides.	Large hides.
	In p o u n d s.	
1851—1853	1,927	—
1859—1861	3,602	6,110
1866—1868	8,518	10,801

From 1870 to 1880 the production continued to increase without much improvement being made in the manufacturing processes.

D A T E.	Number of tanneries.	Number of hands.	Production in roubles.
1871	3,065	14,400	26,111,381
1875	2,764	14 577	26,506,000
1879	3,317	20,132	41,986,300

These figures show that the production in 1871 amounted to 26 million roubles, or 1,200,000 more than that of the preceding year; from that time until the end of 1877 the mean production was about 27 million roubles per annum. In 1878 it rose with a bound to 42 million, that is to say, that during the space of two years it increased 55 per cent. This sudden increase was due to a very lively demand for boots and other leathern goods during the Russo-Turkish war. The following statistics show the state of the trade during the subsequent years.

D A T E.	Number of tanneries.	Production in roubles.	Number of hands.
1880	3,563	42,057,000	20,689
1881	3,566	37,713,000	20,085
1882	3,525	37,640,000	19,656
1883	3,551	38,611,000	19,572
1884	3,179	38,093,000	19,685

During the first year after the war the trade was still engaged in completing the large orders given during the campaign as the operations of tanning and dressing the thick hides required for boot soles and for strapping occupy about a year, and consequently the pelts received in 1879 were only finished in 1880. In that year the maximum production of the Russian leather trade was attained. In the following year it fell to 37 million roubles, or about 10.2 per cent, and then during the three subsequent years, up to 1884 inclusive, it averaged very nearly 38 million roubles, which is about 11 million roubles or 29 per cent more than the average of the preceding ten years, excluding the two years of the Russo-Turkish war. The production during the next five years is shown by the annexed table.

T R A D E.	1885.			1886.	1887.	1888	1889.		
	Number of tanneries.	Production in thousands of roubles.	Number of hands.	Production in thousands of roubles.			Number of tanneries.	Production in thousands of roubles.	Number of hands.
Tanning	2,248	36,640	19,032	39,392	39,864	39,002	2,300	38,034	21,511
Leather dressing and sheep-kins.	259	2,007	2,141	1,728	3,178	1,759	222	1,730	3,052
Leather goods. . . .	46	1,682	1,500	1,607	1,757	2,210	82	2,224	2,960
Total	2,553	40,329	22,676	42,727	44,799	42,971	2,604	41,988	27,523

The rapid increase in the number of tanneries and in their production greatly depended upon the development of some branches of the leather industry which had hardly existed before that time. For instance in former years a large quantity of horseskin shoe leather and sewn uppers had been imported under the name of Hamburg goods, and of late years the home manufacture of this article greatly spread, and by reason of its low price soon diminished the import. The following tables for 1888 and 1889 show the present condition of the tanning, leather dressing and sheepskin trades and of the production of leather goods, taken from statistics relating to the best known firms:

LEATHER TRADE.	1888.			1889.		
	Number of tanneries.	Production in thousands of roubles.	Number of hands.	Number of tanneries.	Production in thousands of roubles.	Number of hands.
Russia in Europe without Finland	1,896	34,994	1,811	1,955	35,510	19,115
The Caucasus.	60	1,629	717	63	410	611
Siberia and Turkestan. . . .	295	2,379	1,752	282	2,123	1,785
Total	2,251	39,002	4,280	2,300	38,043	21,511

At the beginning of 1890 the total number of tanneries in Russia was 2,300, with a production of about 38 million roubles, and employing 21,511 men. Besides this, in Finland in 1888 there were 602 with a production of 303,000 roubles, and employing 1,903 hands.

The largest and most advanced tanneries are situated in the Baltic region, and in the government of St. Petersburg in particular. Towards the end of 1889 the

production of the 41 tanneries of this district was valued at 4,572,000 roubles and they employed 1,514 men. The largest tanneries are in St. Petersburg itself, that of Brousnitzin & Sons ranking first. This establishment was founded in 1847, when the output consisted of 4,000 hides valued at about 50,000 roubles; in 1878 the production increased to 40,000 hides or 800,000 roubles per annum. Their goods consist of thick boot sole leathers made of American pelts, belting and half-dressed hides; and by adopting the latest improvements in machinery and manufacturing processes the present production has risen to 70,000 American and Circassian hides for boot soles, belting and half-dressed hides, valued at 1,600,000 roubles. Last year these works were considerably altered and enlarged to the capacity of 90,000 hides. The works possess 4 steam boilers, two 100 horse power steam engines, as many as 1,100 various vats, many special machines and a fitting shop. They are lighted by electricity, and employ 500 hands; 450 are lodged free of charge in a model lodging house on the premises, a doctor being also provided. The workmen attend the classes of the Imperial Russian Technical Society, to which the owners largely contribute. Ossipov's tannery was founded in 1857; it has one 20 horse power steam engine and produces 50,000 boot sole and half-dressed hides to the value of 722,000 roubles and employs 180 men. Paramonov's tannery, established in 1883, and has 2 steam pumps; it produces 27,000 hides valued at 445,000 roubles and employs 95 hands.

In the central region, the Governments of Tver and especially that of Moscow are most important. The total production of these two governments in 1889 was 5,520,000 roubles, and of this 3,792,000 fell to the share of the 52 tanneries in the government of Moscow in which 2,770 men are employed, the remaining sum of 1,728,000 being the production of the 65 tanneries of the government of Tver, employing 1,222 men. The other governments of the central region contain very few large tanneries. The principal Moscow firms are: 1. Alexis Vakhroushin & Sons, established in 1834; it has one 20 horse power steam engine, dresses 259,000 goat-skins, sheepskins, calfskins and bull hides valued at 694,000 roubles, and employs 560 men; there is a free school on the premises for 200 pupils of both sexes. 2. Michael Zhemochkin & Sons, founded in 1853, driven by one 12 horse power steam engine, yearly production 18,800 boot sole, American, tanned and other hides to the value of 478,000 roubles, 215 hands; a small hospital is attached to the works. 3. John Shouvalov & Sons, established in 1830; it has two steam engines yielding 35 horse power; the yearly production is about 230,000 hides including a quantity of sheepskin and kid morocco altogether valued at 400,000 roubles; 275 men are engaged in these works. 4. Teal & Co. established in 1883, one 10 horse power steam engine, turnover 27,510 boot soles, Russia leather and tanned hides worth 400,000 roubles, about 100 men employed. 5. Malkiel's tannery, founded in 1880, one 20 horse power steam engine, yearly production of 10,000 various hides worth 750,000 roubles, 150 men employed.

These data show that the Moscow tanneries are not so large as those of St. Petersburg, and in addition, that most of them tan smaller hides which fetch lower prices. The leather trade of the government of Tver is intimately connected with the shoemaking business, which is widely spread, both as a manufacturing and as a village industry. The principal centres of the leather trade are the districts

Korchevsk and Rzhevsk and the towns of Ostashkov and Torjok. Potapenko's tannery is one of the largest; it is situated in the Korchevsk district, was founded in 1879; its yearly production amounts to 655,000 roubles, possesses one 4 horse power steam engine and employs 210 men, turning out over 60,000 hides per annum. The firm of Savine has 13 tanneries owned by different individuals in the town of Ostashkov; the yearly production of each of these does not exceed 100,000 roubles, excepting that belonging to Theodore Savine, founded in 1740 and famed for its Russia leather dressing. It possesses 3 steam engines generating altogether 52 horse power and employing 473 hands: its yearly production amounts to 116,000 hides valued at 553,000 roubles.

The governments composing the eastern and south-eastern region, and particularly those of Viatka, Perm, Kazan, Samara and Saratov, form important centres of the leather trade, both as regards the number of tanneries and their total yearly production. The separate output of each tannery in this region is however small and the large total is made up of the production of the numerous small tanneries. The mean yearly output of the tanneries of Viatka does not exceed 43,000 roubles, that of the government of Perm being only 11,000, whilst the yearly average production of the Saratov tanneries is as small as 4,700 roubles, the total number being 117, so that the whole government has a production of 554,000 roubles. The government of Viatka ranks first in importance, having 77 tanneries employing 1,780 men, the total production being 3,298,000 roubles. The largest works are in the town of Viatka, Slobodsk and Nolinsk.

The principal governments of the southern region are those of Kiev, Chernigov and Kherson; the number of tanneries and the production of the first two being almost equal, namely: in the first, 58 tanneries, with a production of 1,129,000 roubles, in the second, 62 tanneries, with a production of 1,386,000 roubles. In the government of Kiev the chief centres are the towns of Kiev, Berdichev and Smela. The district of Berdichev contains Shlenker's large tannery established in 1875: it has 2 steam engines generating 75 horse power; its yearly production amounts to 33,300 hides valued at 320,000 roubles and employs 127 men. A small hospital is attached to the works of Kobets's tannery in the neighbourhood of Kiev; it is considerably smaller, its yearly production being only 100,000 roubles; it was founded in 1845, has a 20 horse steam engine and employs 24 men; it turns out 16,500 hides per annum. Small tanneries with a production from 3,000 to 25,000 roubles predominate in the government of Chernigov. There are 16 tanneries in the government of Kherson, employing 475 hands and having a total production of 1,070,000 roubles; they are principally situated in the town of Odessa, the principal being Paraskev's, founded in 1858; it has 2 steam engines of 30 horse power, turns out 21,500 hides valued at 400,000 roubles and employs 117 men. Koadzaki's tannery has two steam engines and employs 38 men; the yearly production is 362,000 roubles or 36,200 hides. The Olviopolsk Tanning Co. in the district of Elizavetgrad was established in 1869; its production amounts to 180,000 roubles or 12,000 hides; it has one steam engine and employs 70 men. Most of the tanneries in the government of the western region are small excepting Malkiel's works in the Rejitsk district of the government of Vitebsk. This tannery was established in 1842: it has one 18 horse steam engine and 320 vats; its production amounts to 58,000 boot sole and half-tanned hides.

The governments of Poland occupy an important position in the leather trade and the principal Polish tanneries are by no means inferior to the best Russian works, both as regards the quantity and quality of their production. There are 210 tanneries in Poland and their total production amounts to 6,660,000 roubles, 58 of these with a total production of 5,554,000 roubles belonging to the government of Warsaw. Next comes the government of Radom with 25 tanneries and a production of 417,000 roubles. The principal Warsaw firms are: Temler, Schwede & Co., founded in 1819; these works have 2 steam engines of 60 horse power. Since 1881 this establishment has endowed a refuge for 190 children of both sexes. The yearly production is about 164,400 hides or 1,518,000 roubles; over 300 men are employed. The Shlenker Brothers tannery, founded in 1839, possesses two engines of 65 horse power. Here the workmen pay 2 per cent of their wages, and in case of illness receive half their pay and free medical treatment, the deficit of this, or about 2,000 roubles, being paid by the firm. The yearly production of this tannery is 820,000 roubles or 52,500 hides and 105 men are employed.

Pfeiffer's tannery, founded in 1854, has two steam engines giving 45 horse power. There is a school for workmen's children, a doctor, chemists shop and ambulance attached to the works. The yearly production amounts to 697,000 roubles or 139,400 hides, and 230 men are employed. Veigley's tannery, established in 1869, one 25 horse steam engine, comes next; at these works there is a fund to which the workmen subscribe for providing a doctor and giving assistance in cases of illness or death. The production amounts to 266,000 roubles or 28,000 hides; 120 men are employed.

There are two or three large tanneries in the government of Radom having a yearly production of over 100,000 roubles, and this sum is only exceeded by Karch's tannery in the town of Radom, the production of this firm being about 117,000 roubles or 17,000 hides; 60 hands are employed.

This brief survey of the state of the tanning and leather trade of Russia in Europe may be concluded with a few statistics relating to the industry in the Caucasus, Siberia and Turkestan, about 1890.

The Konban district is the principal leather centre in the Caucasus, having 42 tanneries with a total production of 227,000 roubles. In the whole of the Caucasus there are 63, with a production amounting to 401,000 roubles. In Tiflis there is a large tannery, belonging to Adelkhan & Co., established in 1875; this firm was awarded the prize for boot sole and other kinds of hides at the Moscow Exhibition of 1882.

The leather trade of Siberia is principally centred in the governments of Tobolsk and Tomsk; in the former there are 90 tanneries with 727 hands, the yearly production amounting to 806,000 roubles, and in the latter there are 72, with 329 men and a yearly production of 349,000 roubles. The Kolmogorov works is one of the largest tanneries in the government of Tobolsk; it was founded over 100 years ago and has a production of 247,000 roubles or 35,912 hides.

In the Turkestan region there are 73 tanneries with 478 men and a production of 586,000 roubles; they are principally located as follows: Syr-Daria district, 13 tanneries, production 204,000 roubles; Semirechinsk district, 26 tanneries, production 127,000 roubles; and the Akmolinsk district, containing 14 with a production of 123,000 roubles. The majority of these tanneries are small and their production insignificant.

FUR DRESSING AND SHEEPSKIN TRADE.	1888.			1889.		
	Number of firms.	Production in thousands of roubles.	Number of hands.	Number of firms.	Production in thousands of roubles.	Number of hands.
Russia in Europe without Fin- land	199	1,505	2,264	186	1,410	2,516
The Caucasus.	2	6	8	1	2	2
Siberia and Turkestan. . . .	40	248	439	35	318	534
Total	241	1,759	2,711	222	1,730	3,052

In addition to this there are three sheepskin dressing firms in Finland having a total production of 16,000 roubles and employing 21 men.

The fur dressing and sheepskin trade is principally located in the eastern, northern and central governments of Russia in Europe and partly in Siberia. Besides being a manufacturing industry it also sometimes appears as a branch trade of the tallow and tanning works. Up to 1890 the total number of fur dressing and sheepskin firms was 222, their total production amounting to 1,642,000 roubles; besides this, 32 tallow works and tanneries dressed 103,000 roubles worth of sheepskins. Out of the 186 fur dressing and sheepskin works in Russia in Europe 38, with a total production of 210,000 roubles, belong to the government of Viatka. The eastern region comprises the following governments: Perm with 20 firms whose united production amounts to 139,000 roubles, Saratov with 24 firms and a production of 77,000 roubles, and Kazan with 3 firms and a production of 52,000 roubles.

The largest firms of the government are located in the town and district of Slobodsk, one of the principal in that town being Shelvakov's, which makes a speciality of sheepskins and sheepskin coats, their yearly production being about 25,000 of the former and 4,500 of the latter; they employ 40 men and do business to the amount of 30,000 roubles a year. Another large establishment belonging to Rospopov dresses 300,000 squirrel skins per annum, costing 32,000 roubles and employing 12 men. Oglobin's factory in Slobodsk has a yearly production of 29,000 roubles and manufactures fur coats and jackets and sheepskin pelisses, employing 50 men. The centre of the fur dressing industry of the government of Perm is the town and district of Shadrinsk the principal firm being that of Botshagov, established in 1881, and having a production of 60,000 roubles a year. The chief fur dressing works in the government of Vladimir are that of Tourpanov, founded in 1882, the yearly production amounting to 60,000 roubles and consisting of 50,000 sheepskins and 4,000 fur coats employing 60 men; that of Tourlapov, founded in 1886, located in the town of Shoua, yearly production 70,000 roubles, consisting of 50,000 sheepskins, 60 men employed; that of Poukhov, established in 1850 in the same town, yearly production about 62,000 roubles, consisting of 40,000 sheepskins, 51 men employed; that of A. Tourlapov, founded in 1840 in the district of Shoua, yearly production 68,000 roubles, or 50,000 sheepskins,

120 men employed; and that of J. Tourlapov in the same district, established since 1882, yearly production 52,000 roubles, 30,000 sheepskins, 45 men employed.

LEATHER GOODS TRADE.	1888.			1889.		
	Number of factories.	Production in thousands of roubles.	Number of hands.	Number of factories.	Production in thousands of roubles.	Number of hands.
European Russia	83	2,172	3,438	77	2,199	2,926
Siberia	4	33	32	5	25	34
	87	2,210	3,470	82	2,224	2,960

The present condition of the manufacturing leather goods trade, taken as an independent branch of the tanning industry, may be judged by the following statistics: the manufacture of boots and shoes, gloves, gauntlets, harness, trunks and small articles, such as purses, is carried on in 82 factories, employing 2,960 hands; 75 of these factories, whose united production amounts to 2,186,000 roubles per annum and having a total of 2,892 hands, are situated in Russia in Europe. There are also 2 factories employing 34 men and having a production of 13,000 roubles in Poland, and in Siberia there are 5, employing 34 men and having a production of 25,000 roubles. The most important factories are located in the government of Moscow where there are 20 with a united production of 707,000 roubles. The principal firms manufacturing boots, shoes and harness in the town and district of Moscow are: 1. Malkiel's factory established in 1879; it has 3 steam engines with a total of 47 horse power, the yearly production amounting to 200,000 roubles, and 120 men are employed. 2. Barykhanov's factory, founded in 1839, engaged in the manufacture of artillery harness, yearly production 185,000 roubles, 80 men employed.

The glove factories are very numerous and vary greatly in size, from the smallest which turn out less than 1,000 dozen per annum, to the largest, like Timister's factory, which turns out 10,000 dozen, worth 150,000 roubles; this firm employs 120 men and has one 8 horse power steam engine. Sorokin's factory turns out 5,000 dozen per annum; it was founded in 1871; Doubensky's factory has about the same production.

The St-Petersburg factories are in point of production by no means inferior to those of Moscow. The St-Petersburg manufactory for machine-made boots and shoes, established in 1877, has a yearly production of 600,000 roubles and turns out over 200,000 pairs of men and women boots and shoes; the machinery is driven by one 25 horse power steam engine: 508 men are employed. There is a chemist's shop and a doctor's office on the premises. The firm subscribes to the Narva school for working men's children. Another large factory, belonging to Southam, manufactures

leather belting and hose pipe; it was founded in 1882, has one 8 horse power steam engine, and an annual production of 140,000 roubles. There is also a special purse manufactory belonging to Gustman, founded in 1883.

The government of Perm ranks third in importance in this branch of industry; it has 23 factories with a total production of 311,000 roubles; next comes the government of Livonia with 2 leather goods factories with a total production of 210,000 roubles, and the government of Tula comes last with two factories having a total production of 165,000 roubles. The principal factory in the government of Livonia is Shleiher's Glove Manufactory in Riga, founded in 1870; its production amounts to 200,000 roubles per annum; 250 men are employed in it.

IMPORT OF LEATHER GOODS.

These may be divided into 4 classes: *a.* raw hides, pelts; *b.* tanned and dressed hides, straps, belting, varnished leather; *c.* furs; *d.* leather goods, such as boots, shoes and harness.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
	R O U B L E S.						
a. Raw hides. .	2,484,003	2,419,785	1,308,767	1,233,478	3,611,895	4,339,336	3,642,157
b. Tanned hides.	4,635,544	5,647,999	4,711,685	4,456,449	3,601,106	4,267,291	4,412,518
c. Furs	8,237,279	8,640,855	8,598,046	4,265,106	6,981,266	7,534,773	5,489,668
d. Leather goods.	1,133,394	969,905	885,873	792,587	564,128	833,799	670,422
Total . .	16,490,220	17,678,544	15,504,371	10,747,620	14,758,395	16,975,199	14,214 765

The import of leather and leathern goods in 1884 amounted to 16,500,000 roubles; in 1885 it showed a considerable increase but afterwards began to decline, and in 1887 fell to the minimum of 10,750,000 roubles; after that it again rose and in 1889 reached 17 million roubles. These fluctuations are in strict accordance with those of the native industry and clearly show the indirect proportion between the import and the progress of the internal trade. In 1885 the home production amounted to 40,300,000 roubles and the import to 17,700,000. In 1886 the production showed an increase of about 2 millions and the import decreased by almost the same sum. In 1887 the production attained the maximum of 44,800,000, roubles and the import fell to its lowest point of 10,700,000, after which the production began to fall off and the import accordingly rose. Upon examining the various items of the import it will be found that the furs are the most important, as they average about 46.75 per cent of the total, excepting in 1887. The next important article is tanned and dressed hides, which are fairly constant at about 30 per cent of the total import next come the raw hides averaging about 17.25 per cent, and lastly the leather manufactured goods averaging about 5 per cent of the total import.

The import of raw hides amounted to 163,222 pounds in 1869, and with some slight fluctuations continually increased. From 1869 to 1872 it reached the yearly average of 308,638 pounds and during the next period of four years, from 1872 to 1876, the mean yearly import rose to 320,460 pounds. In 1877 this import decreased to almost one-half, or 185,726 pounds. During the next period of four years, from 1878 to 1881, the import of raw hides showed great variations, but attained the very high average of 507,168 pounds, that of 1879 being the highest, namely 745,677 pounds. After the introduction of the customhouse duty in 1882 the import of raw hides through the European frontier showed a constant decrease, the average for 1882 and 1883 being 321,473 pounds, and the mean yearly import during the three years period from 1884 to 1886 fell to 243,815 pounds or 2,033,988 roubles. The total import through the European, Finnish and Asiatic frontiers was as follows, exhibiting a marked decrease every year:

1884	2,484,003 roubles
1885	2,419,785 »
1886	1,614,184 »

During the next five years the import fluctuated considerably but showed a great tendency to rise, as seen by the item a. in the table of the leather goods import, increasing suddenly in 1889 to the sum of 2,484,003 roubles, or 60 per cent higher than in the preceding year; the import rapidly decreased and in 1887 it fell to 1,233,478 roubles, in 1888 however it again rose to 3,611,895 roubles; in the following year of 1889 it increased to 4,339,336 roubles and in 1890 it again decreased to 3,642,157 roubles. The import of salted hides showed the greatest fluctuations; in 1887 it amounted to 406,350 roubles and in the following year it increased to 2,066,944 roubles or five times.

Of late years the import has chiefly consisted of American bull hides, as there are not many large bulls in Russia. The hides of the Russian cattle have a tendency to become thinner, and yet they are becoming more expensive. In St. Petersburg fresh raw hides of Circassian cattle, weighing from 60 to 70 pounds per hide, cost from 3.60 to 4.20 roubles per pound, and American salted hides from Rio Grande, Buenos Ayres and Rio Janeiro, weighing from 70 to 80 pounds per hide cost 6.50 to 7.50 roubles. The import of foreign thick hides does not only arise from the insufficient quantity of Circassian hides, but also from the fact that American thick hides are in many cases indispensable for manufacturing the heavier kinds of sole leather and belting. The American hides are principally imported in the salted state.

From 1869 to 1884 inclusive, the import of dressed hides constantly increased. This increase was uninterrupted from 1869 to 1876 but in the latter year, just before the duty was considerably raised in consequence of its being charged in gold, the import suddenly showed a considerable increase, and then in 1877 it greatly diminished; in 1878 it again rose and exceeded the amount of all the preceding years, and kept on increasing until 1884. From this date the import of dressed hides has remained pretty constant, excepting a slight rise in 1885 and a fall in 1888, and keeps very near the average of 4,500,000 roubles, or 30 per cent of the total

import, or 10 per cent of the home production. The greater part of the dressed hides are supplied by Germany, about 60 per cent. and Great Britain, about 30 per cent. whilst Austro-Hungary and France send small quantities. The chief items of this import are small and large hides, varnished leather and belting.

The import of varnished leather from 1887 to 1890 only experienced very slight fluctuations and kept very near the average of 2,192,000 roubles. The import of belting during the same period averaged about 980,000 roubles; it fell to its lowest point of 895,586 roubles in 1888, and reached the maximum figure of 1,145,985 roubles in 1884. and in 1885 fell to 927,019 roubles. The import of furs varied on the average between 4,250,000 to 8,500,000 roubles, the principal kinds being sable, black fox and muskrat. other kinds being but very little imported. The import of wrought leather is small and consists of boots and shoes, gloves, saddlery and harness.

LEATHER EXPORT TRADE.

The export of leathern goods may be classed under the same four heads: a. raw hides. b. dressed hides. c. furs, d. wrought leather goods. The amounts during the period from 1884 to 1890 are given in the following table.

	1884.	1885.	1886.	1887.	1888.	1889.	1890.
	R O U B L E S.						
a. Raw hides. .	4,521,021	4,067,842	5,076,510	5,729,156	5,312,967	4,257,998	5,530,542
b. Dressed hides.	675,472	984,255	1,698,793	2,071,775	1,384,967	1,636,964	956,946
c. Furs	4,020,083	3,385,298	5,446,372	3,938,757	4,242,843	6,238,845	5,163,737
d. Leather goods	718,668	160,000	389,208	1,100,408	971,980	780,779	894,294
Total . .	9,935,244	8,597,395	12,610,883	12,840,096	11,912,757	12,914,586	12,545,519

Generally speaking the import exceeds the export. In 1884 the export amounted almost to 10,000,000 roubles; in the following year it decreased, and in 1886 rose to 12,500,000, and finally, excepting some slight fluctuations, kept fairly steady at the average of 12,500,000 roubles up to 1890.

The principal item of export was raw hides which, in 1884 and 1885, amounted to about 4 million roubles and from 1886 to 1890 averaged 5 millions. The next important item is furs, the mean export of which was 4,500,000 roubles, but varying greatly each year. The next two items averaged 1,300,000 roubles and 700,000 roubles respectively.

The export of raw hides through the European frontier during the decade ending 1879 averaged 234,553 pounds per annum, from 1880 to 1883 it rose to 358,421 pounds, then fluctuated considerably from 1883 to 1886, the mean yearly

export for the three years being 341,575 pounds or 4,225,901 roubles; during the next half-decade it rose nearly 1,300,000 roubles above that of the previous five years, and averaged 5,500,000 roubles and remained fairly constant during 1887, 1888 and 1890, only falling in 1889 to 4,250,000 roubles. This export may be divided into small and large hides. The export of large hides varies greatly from year to year: in 1887 it reached the lowest point of 706,203 roubles, but then rose to 1,580,535 roubles in 1890, the mean export from 1887 to 1890 being 1,427,000 roubles. The export of the small hides was a less important item, the yearly average for the same period of 1887 to 1890 inclusive being 3,623,000 roubles, with very slight yearly fluctuations.

The increase or decrease of the export of raw hides does not seem to be the result of a greater or less demand, but rather a matter of chance and principally depends upon the price of fodder. When fodder is scarce the export of raw hides is very large, and the years 1869 and 1870 may be taken as an example to show how greatly this export varies: in 1867 it amounted to 376,382 pounds, and in 1870 it fell to 163,026 pounds; in 1870 it further fell to 143,026 pounds, or only 38 per cent of the preceding year. The greatest demand for the Russian leather exports is in Germany whilst Great Britain and Austro-Hungary import the same articles but only to the amount of 25 per cent of what Germany consumes.

Small, dry hides, principally calfskins, are sent abroad from the governments in the interior, the Baltic region and the south of Russia, through St-Petersburg, Riga and Odessa. Goatskins are exported from the government of Kazan and other eastern governments; horse hides, from the governments along the Volga; and light cow hides from the Nizhni-Novgorod fair. The hides are only sold by weight in St-Petersburg and partly in other parts, in all other places they are sold by the piece. At the Nizhni-Novgorod, Kretshensk, Troitsk and Menzelinsk fairs almost all the goods are also sold by the piece. The export of dressed hides and wrought leather is so small that it may be passed over entirely.

The export of furs from 1880 to 1890 was subject to great fluctuations, but is in general increasing, although not progressively. The average export during the last four years amounted to 4,896,000 roubles, or 31 per cent of the mean total leather export, and 90 per cent of this quantity, or 4,417,989 roubles, passed through the European frontier, while 1 per cent, or 56,786 roubles, was exported through the Finnish frontier, and 8 per cent or 421,271 roubles, through the Asiatic frontier. The chief consumers were Germany, France and Great Britain, and small quantities were exported to Austro-Hungary, Holland, Belgium, Italy and Roumania.

VARIETIES OF LEATHER DRESSED IN RUSSIA.

All well known processes are used in the Russian leather dressing trade, tanning, tawing, stuffing, and consequently there is a great variety of different kinds of leather produced, the following being the most important: I. Tanned leather; II. Tawed leather; III. Shamois leather.

I. Tanned leather.

HEAVY SOLE LEATHER MANUFACTURED FROM AMERICAN. CIRCASSIAN BULL AND BUFFALO HIDES.

The former are principally imported in the salted condition and the latter raw, straight from the slaughter houses. Raw hides are also used for manufacturing heavy driving belts. The peculiarity of sole leather manufacture is that it is not subjected to the action of lye, lime or potash but is treated with old tan liquor mixed with rye flour, and undergoes cold fomentation and sweating. Sole leather is divided into two kinds, one being prepared by the flour process and the other with the tan liquor. The former variety is an old and popular article; the process consists in first washing the hide, then bucking in flour and tanning by sprinkling with oak bark four or five times. The drying is carried on in summer or winter, the latter season imparting a deeper reddish brown tint to the leather. The hides are not subjected to any finishing process and their appearance is not pleasing but they are prized by the lower classes. Liquor-tanned sole leather is a much better known article: the process consists in first washing and scraping the hides, then sprinkling them with salt upon the flesh side, folding them down the middle and laying them in packs. This operation replaces the lye treatment; then follows the depilating process, liquor treatment and tanning, which is repeated four times. In former times sulphuric acid was sometimes added to the liquor to hurry the process, but this proved injurious and was later on abandoned. The tanning of liquor-treated sole leather is generally effected with willow, or oak bark, and sometimes certain concentrated extracts such as wattle, hemlock and sumach are used. The sole leather hides are not subjected to any finishing processes but are only rolled or hammered.

HALF-TANNED SOLE LEATHER.

This leather is manufactured from the lighter bull and cow hides, as it is principally used for making ladies boots. It is also used for making small articles such as cartridge pouches, and inner soles, in which cases the smallest hides are used. The essential difference in the preparation of this variety of leather is that the raw hides, after having been washed and scraped, are treated with a mixture of lime and ashes or potash, according to the method practised in the east of Russia, or only with lime as in the north-west and south; the steeping and tanning then follow, the latter operation being repeated three times. Driving belts are prepared in this manner, but the largest belts are made of large American and Circassian hides, weighing 60 to 80 pounds each. This leather is tanned three times and then passed through rolls or hammered, greased with tallow, cut into strips which are sewn together with thongs, or else fastened with copper rivets.

SOFT LEATHER.

This leather must be flexible and comparatively light, and is therefore generally manufactured from the hides of calves, young cows, barren cows and heifers.

1. *Russia leather.*

This article is prepared from all the above mentioned raw materials except calfskins. After washing and scraping, the hides are treated with ash, then washed, passed through the stamping mill, pared, pressed, tanned in weak liquor and then in ooze, and by sprinkling; it is either white, red or black. The best hides are used for the white leather which, when tanned, is smeared on the flesh side with a mixture of birch tar and seal grease.

The red Russia leather is prepared in the same way, but when dried is coated with a solution of alum and dyed with red sandalwood. The black leather is dyed after tanning with some salts of iron and then smeared on the flesh side with a mixture of birch tar and calf grease. This smearing is repeated, if the so-called tarred Russia leather is required. All this class of goods undergoes various finishing processes to give the requisite appearance. These finishing operations are frequently repeated several times; the dried hides are softened, kneaded, pared with a paring knife, stuffed and rolled upon grained boards to impart a given design to their surface, either fine or coarse shagreen, striped or fancy patterns; if however a smooth or polished surface is required the face is rubbed with glass or stone. When finished the hide is slightly greased with seal grease or tallow. Black tarred goods are smeared with a mixture of tar and grease. Smooth or small grained white Russia leather is principally used for soldiers boots and cartridge pouches, trunks and bags. Red grained Russia leather is sold in Asia and also exported in considerable quantities to western Europe, where it is much prized by foreigners who call it Russia leather and use it for making a variety of small articles, such as purses and cigar cases, for which Vienna is particularly famed. Black Russia leather is dressed smooth or grained and is used by harness makers, trunk makers, coach builders, and also for making ordinary boots and shoes.

2. *Dressed calf leather and calfskins.*

Both these varieties are used for making light boots and shoes and numerous other articles. The raw material in both cases is the hide of young calves, and the processes of manufacture are the same as those of Russia leather, the only changes being those necessitated by the smaller size of the hides. Calfskin is made from the hide of milk calves and is easily recognized by the colour of the flesh side; it is tender, soft, flexible and strong, and is therefore more valued than ordinary calf leather; much of it is sent abroad.

3. *Horse hides.*

The rump part of large horse hides is close and hard and is used for sole leather. The smaller hides are used for making white and black Russia leather, known as Hamburg leather. The hides of milk stallions are used instead of calfskins. The manufacturing processes are the same as those of Russia leather and calfskin. Horse hides are not so highly prized as those of horned cattle. Different kinds of leather are also made from goatskins, sheepskins and lambskins, the following being the principal varieties.

4. *Morocco.*

This may be leather made of goatskin or sheepskin. Goatskin morocco was formerly exported in large quantities to China, but the demand for it there has now greatly decreased, and it is principally used for shoemaking in the interior of Russia. Goatskins are so strong and hard that a strong potash treatment is required to get rid of the hair: they are worked up with dog dung in a rotating cylinder, and in tanned liquor. For tanning, the skins are sewn face outwards into bags, into which the tanning liquor is poured and then covered with fine willow bark, arbuté or sumach. When tanned the skins are dyed, dried, pressed and rolled on grained boards or else smoothed with stones, the grained quality being that used in China whilst the smooth skins are used in Russia.

5. *Ordinary morocco.*

This leather is usually made of sheepskins and lambskins, especially merino sheepskins. In order to avoid damaging the hair whilst removing it, lye sweating chambers and jellies are used, and the morocco is tanned the same as soft leather and then dyed and dressed. Sheepskin morocco is less durable than goatskin morocco and is not suitable for shoemaking.

6. *Lambskins, common or merino.*

This quality is prepared in the same way as small, barren cow hides, and is used for making gauntlets, women cheap shoes, and underwear.

7. *Sheepskins dressed in the wool.*

This leather is used for coats, jackets, collars and the like; it differs in the age and breed of the animal and in the way of dressing. The tanned skins are the most highly prized and the best are from the morlings and Romanov sheep.

II. **Tawed leather.**

There are three varieties of tawed leather, the difference being in the processes used in their manufacture; namely, that treated with flour is called German curried or Hungarian and Kalnuck tawed leather. This article may be manufactured from sheepskins, lambskins, goatskins and calfskins; it has a certain advantage over tanned leather in supporting a greater breaking strain and can therefore be used for belting and harness, but as it is not waterproof it requires to be well greased.

1. *Flour treated tawed leather.*

This variety is a very popular article; it is made by agitating the raw hide in a warm mixture of rye flour and salt; the hair is then removed and the hide treated with flour and alum, after which it is repeatedly washed, dried and greased with an unguent of seal fat, tar and tallow, and finally pressed and dried.

2. *German tawed leather.*

This leather differs from the previous kind in being treated with ash; it has a better appearance but is less durable.

3. *Hungarian tawed leather.*

This quality is stronger than the two above mentioned varieties, as the hair is not removed by the action of chemical reagents, but by scraping with a special kind of knife.

4. *Kalmuck tawed leather.*

Out of this leather remarkably strong straps are made; it is prepared in the following way: the raw hide, without undergoing any preliminary treatment, is cut into strips suitable for straps, scraped on both sides with a sharp knife and liberally greased with tallow and train oil; several strips are then twisted together, hung on a hook and stretched by suspending a weight to the lower extremity, the weight is allowed to turn first in one direction and then in the other, so as to stretch and twist the leather, and finally the greasing is repeated. The thinnest straps made in this way are remarkable for their great strength.

5. *Kid.*

This quality is made of lambskin, sheepskin, sometimes rabbitskin, but the finest quality is made of the skin of milk goats. It is prepared in the same way as tawed leather. The raw or steeped skin is treated with lime, depilated, then treated with a bran and alum mixture, which is different from that usually employed as it contains salt, alum, rye flour and yolks of eggs, one yolk for each skin. Then follow several processes such as washing, kneading, paring, and pressing. If the kid has to be dyed it is pared on a marble slab.

III. *Shamois leather.*

This variety is made of the skin of deer, elk, buck, camel, goat, sheep and calf, the first three being the best. After the usual processes of steeping and depilating the skins are saturated with oil, then rolled repeatedly and exposed to the air to oxidize the oil and remove the excess, then finally dried and stretched.

The following statistics may be recapitulated as showing the condition of the Russian leather trade at the beginning of 1890.

Tanneries and leather works in 1889, in Russia . . .	2,604.
Men employed	27,523.
Production in roubles	42,000,000.
Average production per tannery	16,129.
Production per capita	1,530.
Leather import in roubles	17,000,000.
Leather export in roubles	13,000,000.
Consumption in Russia in roubles	46,000,000.
Consumption in Russia per capita in kopecks	38.

If the village leather industry be also taken into account, the total consumption would be as follows:

Yearly consumption of manufactured goods . . .	46,000,000 roubles
Yearly consumption of the village product . . .	58,000,000 »
<hr/>	
Total .	104,000,000 »
Consumption per capita	0.87

The following figures represent the present condition of the village leather industry.

	Number of undertakings.	Number of men employed	Production in roubles.
Unwrought leather.	9,500	21,000	12,000,000
Wrought leather.	29,000	85,000	26,000,000
Furriery and sheepskin.	—	40,000	20,000,000
Total	—	146,000	58,000,000

The production of each workman amounts to nearly 400 roubles. The total yearly output of the whole leather trade, therefore, amounts to 104 million roubles. and the total number of men employed in it is about 173,523.

These figures prove that this trade is one of the most important in Russia and that the village production exceeds that of the factories by 38 per cent, and is therefore of such importance that it requires to be dealt with separately.

THE VILLAGE LEATHER INDUSTRY.

This occupation is one of the most important in Russia, as its production is very large, and the trade widely spread among the inhabitants. Statistics show that tanning is practiced as a village industry in 44 governments, or 160 districts, occupying about 9,500 households or about 21,000 men, and that the annual production amounts to 12,000,000 roubles or about 28 per cent of that of the factories. The production of wrought leather is spread over 40 governments, or 150 districts, and occupies 85,000 men, the annual production being about 26,000,000 roubles. The large manufactories do not compete to any great extent in this branch of trade, consisting principally of boots and shoes, shamois goods, harness and other kinds of wrought leather. A large number of men are also employed in tanning sheepskins used for clothing in the villages; this business is carried on in 33 governments, and 137 districts, the number of men engaged in it being about 40,000; the value of the yearly production is estimated at 20,000,000 roubles, or about 10 times that of the manufactories. These last figures are probably too small as the number of village furriers most likely would be larger, as many are not registered in the hope of evading the tax levied upon them. It cannot be stated at what precise date the village tanning business originated, but there is no doubt that it existed in this form long before

it became a regular manufacturing enterprise. The landowners rendered some assistance towards developing the industry, as it was their custom to apprentice some of their peasants to some form of trade, these young men, on their return home, practicing their trade on their master's estate. In this way the village handicrafts greatly improved and spread among the peasants.

The village industry, like all others, depends completely upon the economical conditions of life and property of the inhabitants. In those governments where agriculture cannot be carried on to any great extent the village trades are more important and in the agricultural districts they rarely exist except when the peasants are short of land. The village leather industry is under those same conditions which separate every village trade from the manufacturing industries, and is characterized by the small production of each individual producer, the primitive processes still in use and the old fashioned style of wrought leather. These drawbacks are due to the unfavourable circumstances in which the cottagers pursuing this calling are situated, namely, want of capital, insufficient knowledge, and difficulties in procuring raw material and in disposing of their goods. They purchase their raw material in the villages and bazars or from special middlemen. It is also a matter of difficulty for them to acquire the necessary materials for dressing the hides as they are generally unable to procure bark directly from those who collect it and are obliged to buy it from the middlemen, who sell powdered oak and willow bark at 55 to 70 kopecks per poud.

The methods practiced by the cottagers are very simple even crude and primitive. They have rarely a workshop but content themselves with the cottage which they dwell in with their families; the vat used for steeping and tanning the hides is placed in the street and the hides are kneaded and greased at home. Their instruments are likewise very imperfect. The work is generally carried on by the members of the family, and only the more well to do peasants hire workmen, and these generally live with the family, receiving wages which vary greatly according to the locality, 15 to 25 kopecks in the Viatka district, and as much as 55 to 60 kopecks per day in the Vasilsk district of the government of Nizhni-Novgorod, their food being provided. In some places, as for instance in the Chernigov district, the peasants club together to buy materials, and work in common.

The absence of capital and the practice of obtaining raw material on credit has an evil influence upon the quality of the goods, as some of the processes of manufacture are omitted altogether, whilst others are shortened to such an extent as to spoil the quality of the leather: for instance, the tanning process, without taking any special measures to hurry the operation, is not prolonged sufficiently to tan the hides thoroughly, and lasts but three months in the government of Tver, and two or even one and a half months, in the district of Chernigov. The principal consumers are the peasants themselves who are not particularly exacting in their choice. The profits accruing from this trade cannot be regarded as being very large; in the Viatka district they amount to about 5.5 to 6.5 per cent clear profit of their gross receipts. The highest profits are realized by those who do piece work for the large manufactories, hides and materials all being found. In the government of Moscow a cottager assisted by a family of three persons will dress hides to the value of 1,800 roubles a year, and make 13 per cent clear profit.

The latest statistics from private sources tend to show that in some parts of Russia the village leather trade is being absorbed gradually by the manufacturing industry, for instance, in the governments of Tver and Moscow such has been the tendency during the last 30 or 40 years, as that far back the production of the village trade greatly exceeded that of the manufactories, whilst at present it is just the reverse. Recognizing the importance of developing, improving and strengthening the village industries of Russia, the Government and private institutions have continually studied the question and have instituted measures to raise and foster the village handicrafts. As an example of efforts taken in this direction may be cited, the museum of village trades work, organized some years ago by the country states, in Moscow in connection with which there are also ambulating workshops for instructing adult village craftsmen; as additional evidence to the same end, may be cited artisan classes attached to the rural schools, kept up at the expense of the Ministry of Public Instruction for propagating mechanical knowledge among the rural population.

Tanning is carried on as a village industry in the governments of Saratov, Perm, Kazan, Penza, Tver, Poltava, Chernigov, Viatka, and in the Terskoi and Kuban districts of the Caucasus. The extent of the trade varies greatly in the above mentioned localities; thus for instance, in the government of Saratov there are 240 tanners, in the colonies of the Kamyshinsk district there are 165, whilst in the government of Perm there are 500 village tanners, with a yearly production amounting to 200,000 roubles; and in the government of Viatka, although the trade has been of late years developing into a manufacturing industry, the village tanners produce leather goods to the value of 4,000,000 roubles a year.

In the government of Tver there are 166 village tanyards with 350 workmen. By comparing the number of village tanyards with that of the large tanneries together with their respective productions at the present time and 30 years ago, it may be at once seen that the village industry is merging into the manufacturing trade, especially in the governments of Tver and Moscow. The village of Kimry in the Korchevsk district, is a great shoemaking centre, and uses the hides tanned in the surrounding districts. In the village itself and in its immediate neighbourhood the trade has however passed from the village industry to the manufacturing stage. Within the precincts of the village there is a small manufactory belonging to Rybkin and lately in the neighbourhood a large manufactory has been built by Potapenko who makes, in addition to other kinds of leather, horse leather by a special Hamburg process hitherto only employed in Poland.

In the governments of Poltava and Chernigov the village leather trade has not developed much in quantity, nevertheless the absence of leather manufacturing in the former and in the southern portion of the latter, combined with the scarcity of land and dense population have given rise to the establishment of a village tanning trade, the raw material consisting of the skins of domestic animals. The principal centres of the trade are Olishevka, Novysenzhary and Sidnev. At Olishevka the tanning business is carried on in 200 households, and in the other two places, in about 50 or 60 families each. The sale of the hides is somewhat hampered by their inferior quality and they are only suitable for local consumption. The village craftsmen of Sidnev supply the shoemakers in the town of Berezna in the Chernigov district with hides.

The shoemaking and wrought leather trades, harness making, trunk making et cetera, are generally closely connected with the tanning industry. The chief shoemaking centre is the south-eastern part of the government of Tver, especially the districts of Kashin, Kalazin and Korcheva. The village of Kimry is, as has already been stated, celebrated for its boots; it is also the market for the sale of goods from the extensive region where all kinds of boots and shoes are made. The best ladies and side-spring boots at the Moscow Exhibition of 1882 were exhibited by the village shoemaker Stoliarov, who was also awarded a medal at the Exposition of Amsterdam. Ladies boots cost from 2.20 to 4 roubles per pair, men's boots of various kinds, such as high boots, hunting boots, varnished boots, blacked boots and children's boots of good shape and quality are sold by the village shoemakers at the following wholesale prices:

High boots	8.00 roubles.
Hunting boots.	9.00 »
Varnished boots	13.00 »
High calfskin boots	7.00 »
Ordinary calfskin boots	3.65 to 4.00
Hamburg boots	4.40 to 4.80
Kid side-spring	3.60 to 3.90 »
Same with galoches	7.00 »

The following table gives a detailed price list of goods from the Kimry and Taldomsk districts.

	R O U B L E S.	
	FROM.	TO.
KIMRY DISTRICT:		
Cow hide high boots.	3.50	5.
Horse hide ditto	2.25	4.
Medium sized boots	0.90	2.50
Children's ditto	0.60	1.30
White or blacked calfskin boots	1.60	2.50
Women's half-boots, calfskin	2.	2.75
Ditto horse hide shagreen	1.	1.60
Women's half-boots, medium size	0.80	1.70
Ditto children's size	—	1.17
TALDOMSK DISTRICT.		
Leather gaiters.	2.	2.50
Prunella shoes	0.80	1.70
Men's shagreen slippers, trimmed patent leathers.	0.90	1.10
Ditto plain	0.40	0.45
Children's shoes	0.10	0.40

The Kimry boots and shoes are sold in Moscow, Nizhni-Novgorod, at the Little Russia fairs, in Rostov-on-Don, the Caucasus and Siberia. The shoemaking trade is also carried on in the Vesegonsk district of the government of Tver, especially in the town of Krasnyi-Holm and the adjacent villages; this region makes a speciality of heavy work boots which are quite water proof; they cost from 2 to 3 roubles a pair according to the quality and time of year. The white boots made at Ostashkov in the government of Tver are well known, the large turned over boots cost from 2.50 to 3.20 roubles, nailed boots from 4.20 to 5.20 roubles; women's and children's sizes are also made. These boots are principally used by the fishermen in St. Petersburg, Pskov, Yuriev (Dorpat), Reval and Riga. The village shoemakers of the government of Koursk, who are fairly numerous, particularly in the village of Veliko-Michailovka in the district of Novo-Oskolsk, where they number 1,600 men, practice a peculiar division of labour: one man cuts out the boots and is known as a cutter, another sews the uppers together whilst a third sews on the sole, makes the heels, fits the boots on the trees, and finishes them off. In winter the prices are uniform, rising a little in spring, and in autumn they are considerably firmer; this is due to the varying demand.

The shoemaking trade also pervades some of those places which have been cited as centres of the leather making industry, such as the Alexeyevsk group of villages in the government of Saratov and its district, where about one-third of the male population are engaged in the village shoemaking trade; the government of Poltava, the southern part of that of Chernigov, in the Oposhninsk volost of the Zenkovsk district; in the government of Poltava there are as many as 500 shoemakers, whilst in the town of Berezna in the government of Chernigov and its district there are over a thousand. In the government of Perm the shoemaking trade is carried on at the Nevyansk and Berezovsk works of the Ekaterinburg district, where there are 228 shoemaking establishments, with 1,075 workmen and a yearly production of 500,000 roubles. The shoemakers of the Irghinsk works in the Krasnooufinsk district, numbering 500 families, have a like production. There are many such groups of village shoemakers in the government of Perm; their total production amounts to over 2,000,000 roubles and their goods are partly sold for local consumption or, for the greater part, sent to Siberia.

The various kinds of leather goods made by the village artisans of the government of Viatka have been already mentioned, and judging from the samples of boots, trunks, knapsacks, purses et cetera, exhibited at the Kazan Industrial Exposition of 1890, they seem to be of excellent quality. Saddlery and harness making are mostly connected with shoemaking in the government of Perm, but also exist independently in the Ekaterinburg and Koungoursk district; they are carried on also in the government of Penza and are in a fairly developed condition in the Caucasus, especially in the Terskoi and Kuban districts.

The chief centres of the fur dressing trade, and particularly of the manufacture of sheepskin coats, are the governments of Viatka, Perm, Chernigov, Poltava and Kiev. The districts of Slobodsk and Viatka are the headquarters of the village furriers of the government of Viatka, their yearly production amounting to 850,000 roubles; and their fur jackets are deservedly popular. The village fur trade of the government of Perm is only capable of supplying the local demand.

In the Romensk and Pereyaslavsk districts of the government of Poltava the village furriers carry on a great trade in sheepskin dressing and the manufacture of sheepskin coats and jackets, which they cut and trim to suit the taste of their customers and the demands of the market. The trimming consists of braid, embroidery, common sorts of Astrakhan or other cheap fur. The price of these fur coats and jackets ranges from 9 to 12 roubles, according to their quality, and sometimes reaches 27 roubles. Quantities of these goods are sent from Berezna to Dobrianka in the Gorodniansk district and to Homel in the government of Moghilev. Besides this the village sheepskin dressing trade is carried on in a small way in Reshetilovka in the government of Poltava and in Koropa in the Krolevetsk district.

The sheepskin coat trade has existed for a very long time in the Kanevsk district of the government of Kiev, the village of Bogouslav having almost the monopoly and containing 180 household furriers. They obtain their raw material from the Little Russia fairs and dispose of their goods, valued at about 60,000 roubles a year, at the local markets. The fur-dressing trade is carried on in some districts of the government of Penza, in those places where leather dressing exists as a village industry. The village Ramzay in the district of Penza is among other places, noted for its sheepskin and fur-dressing trade.



CHAPTER VII.

India rubber trade.

CAOUTCHOUC made its first appearance in Europe towards the end of the last century, whilst gutta-percha was not known until the middle of the present. The manufacture of caoutchouc was however only started at the commencement of this century, the first patent being granted to Mackintosh in 1828 for his process of dissolving caoutchouc in naphtha oil and applying the solution to clothes. An invention for making thread out of caoutchouc was brought out about the same time. This trade was, however, most materially developed by the discovery of vulcanizing caoutchouc by treating it with sulphur, made by Mr. Ludersdorf in 1882. The vulcanizing processes discovered by Goodyear in America in 1839 and by Hancock in England in 1843, have placed the india rubber trade on a level with the other manufacturing industries.

This trade sprang up in Russia soon after 1830. The first factory was opened in St. Petersburg by Henry Kirstein. In 1844 there were already two manufactories, their united production in 1845 amounting to 90,080 roubles and rising to 132,072 roubles in 1849. In 1852 there were four manufactories, but in the following year three of them closed, that of Kirstein alone remaining. This decline of the india rubber trade may be attributed to its comparatively early stage of existence; the choice of goods manufactured was not made with sufficient judgment and the prices were high.

The Government saw the necessity of this trade, which had only begun to develop, and in 1857 raised the import duty on foreign india rubber and gutta-percha goods. This circumstance placed the trade under particularly favourable conditions and it rapidly developed. In 1860 there were five mills employing 298 hands and having a production of 412,160 roubles. In the same year the Russian-American India Rubber Manufacturing Company was established in St. Petersburg. This establishment began to work with the greatest success and made astonishingly quick progress, thanks to the good quality of its goods. The galoches were even soon sold

abroad, in spite of the immense internal consumption. In 1883 Kirstein's manufactory was consolidated with the Russian-American Company, which became so powerful that all smaller mills which sprung up from time to time were soon obliged to suspend operations. Thus in 1870 there were four mills, in 1871 there were only three, in 1872 three new mills were started and one of them, the Mackintosh, was bought up by the Company in 1880, whilst the others were closed. The success of this concern may be easily gauged by observing the increasing production of india rubber galoches; in 1860 to 1861 it amounted to 220,223 pairs, in 1870 and 1871 it rose to 1,804,634 pairs, and in 1880 and 1881 it was as high as 2,313,378 pairs. The demand for these goods abroad is a sufficient proof of their good quality; in 1870 and 1871, 57,207 pairs were sold in Germany and Sweden and in 1880 and 1881 the export rose to 269,437 pairs. The production in 1886 and 1887 amounted to 3,300,000 pairs of which 2,750,000 were sold in Russia, 400,000 were exported to Sweden and Norway, and 150,000 to Germany, Denmark and other countries.

During the struggle between this manufactory and its competitors the most formidable resistance was encountered from a manufactory in Livonia, the production of which was, however, greatly inferior to that of the Russian-American Company. Besides regular india rubber works which manufacture their goods from the raw caoutchouc and gutta-percha, there are many small mills which purchase ready made rubber and india rubber coated cloth from abroad or from Russian rubber works and manufacture elastic fabrics, and waterproof clothing.

The development of the india rubber trade during the second half of the decade, after 1880, is shown by the fact that in 1885 there were 2 mills with 1,750 hands and a production of nearly 7 million roubles, or, more exactly, 6,976,000 roubles, and in 1889 there were 9 mills with 3,273 hands and a production amounting to 10,300,000 roubles; besides this there are 2 mills in Finland, and their production in 1888 was officially returned at only 13,000 roubles. The following statistics prove that the trade is rapidly progressing in spite of the drawback of importing all the raw material.

In the government of St. Petersburg there is one large india rubber manufactory belonging to the Russian-American Company. It was established in 1860 with a capital of 500,000 roubles. In 1878 the working capital was increased to 2,000,000 roubles and a reserve fund of 1,400,000 roubles was added; the production amounted to 5,000,000 roubles and consisted of galoches and all kinds of rubber goods. In 1892 the working and reserve capitals were raised to 6,000,000 roubles. At present the capacity of this mill is sufficient for a production of 10,000,000 roubles. The plant includes 22 steam boilers, 25 steam engines of 2,120 aggregate horse power, and 380 rolling, washing and auxiliary machines; there are 2,873 hands of which 1,387 are women. Galoches and all kinds of india rubber articles are manufactured at this mill; the galoches are sold over all Russia and sent abroad in large quantities, the export being as high as 1,000,000 pairs.

There are two mills in the government of Livonia, possessing 9 steam boilers and 13 steam engines yielding 650 horse power. Their yearly production amounts to 645,000 roubles and they employ 510 men. Mündel's works in Riga were founded in 1864; they have survived a prolonged competition with the Russian-American Company; they manufacture galoches, surgical appliances, et cetera, to the value of 200,000

roubles a year, and employ 101 men. There is one india rubber manufactory in the government of Moscow belonging to the Moscow India Rubber Company, established in 1888; it has one steam boiler and 3 steam engines generating 250 horse power; its production amounts to 1,000,000 roubles and employs 370 hands. In Poland there are two small mills with 2 steam boilers and 2 steam engines with a total of 21 horse power; their united production is equal to 258,000 roubles, and they employ 180 men.

The rapid progress achieved by the Russian india rubber trade conveys the assumption that the import of foreign rubber goods should be steadily declining, and this is proved by the following figures.

IMPORT OF CAOUTCHOUC GOODS:			
	1884.	1885.	1886.
Pouds	11,701	11,933	10,307
Value in roubles. .	566,580	411,034	320,982

Statistics of the previous years show that the import reached its highest stage during the period from 1876 to 1881; in 1882 it began to decline and from 1884 shows a decided decrease. During the second half-decade of 1880 fluctuations again occurred, as shown by the following table.

VARIOUS IMPORTS.	1887.	1888.	1889.	1890.
	R O U B L E S.			
Pure gum elastic and gutta-percha goods . .	266,094	234,671	251,036	268,012
Gum elastic, thread fabrics	5,840	2,885	3,599	2,922
Gum elastic boots and shoes	201	162	150	323
Goods of gum elastic and gutta-percha mixed with other matter	62,889	39,329	32,329	41,531
Total.	335,024	277,047	287,114	312,788

The largest item is made up of the pure gum elastic and gutta-percha goods; next come those made of a mixture of rubber and other substances; gum elastic thread fabrics are imported in small quantities, and rubber boots and shoes only appear occasionally as an import. The total import does not amount to more than 3 per cent of the internal production.

The export of india rubber and gutta-percha goods increases as the import decreases. The following tables show, however, that this increase was not without considerable fluctuations.

The export of caoutchouc goods through the European frontier may be seen below, in yearly averages during stated periods:

	1869—1875.	1876—1878.	1879—1883.	1884—1886.
Pounds. . .	2,795	12,275	6,881	10,596

The export through the European and Asiatic frontiers was as follows:

	1884.	1885.	1886.
Pounds. . .	21,286	22,493	22,327
Roubles . .	885,909	432,444	682,709

Thus during the space of 17 years the export increased eightfold, or from 2,795 pounds in 1869, to 22,327 pounds in 1886.

The next table shows the state of the export during the second half-decade of 1880.

EXPORT FROM RUSSIA.	R O U B L E S.			
	1887.	1888.	1889.	1890.
Gum elastic and gutta-percha goods. .	371,400	157,299	55,836	186,242
Gutta-percha boots and shoes.	—	1,162,399	1,470,706	1,056,137
Total.	371,400	1,319,698	1,526,542	1,242,379

A still greater increase in the export of rubber and gutta-percha goods is shown in the second half of the decade, although accompanied by considerable fluctuations. The largest item consists of gutta-percha boots and shoes, which in 1889 amounted to 1,470,706 roubles, the total export for that year being 1,527,000 roubles. From 1885 to 1889 the production of the india rubber industry and its foreign trade increased from 6,976,000 roubles to 10,312,000, or about 50 per cent. During the same period the import decreased almost 30 per cent, and the export showed a rise of over one million roubles. At present the export is equal to about 14.8 per cent of the total production, and the import, about 2.8 per cent.

The produce of a large india rubber mill consists of materials and manufactured goods; the materials are, sheet rubber, semi-transparent, made out of raw rubber, rubber glue, which is a solution of raw india rubber in benzine, and india rubber thread. These materials are prepared from pure natural india rubber, and their cost is somewhat high; the glue, for instance, costs 1.50 roubles per pound, the sheet rubber, 2 roubles and the rubber thread, from 2.50 to 3 roubles per pound. Another material called horn rubber, or ebonite, is made by treating india rubber with a considerable quantity of sulphur at a comparatively high temperature and mixing it with litharge and lampblack; a compact hard substance is thus obtained which is capable of being planed, turned and polished, and is much used for making a va-

riety of goods. The price of ebonite is about 3 roubles per pound and does not depend so much upon the expense of the raw materials as upon the costly nature of the process of manufacture.

These materials are either used in the manufactory for making various goods, or sold to small factories and shops for making small rubber articles. These india rubber wares are of almost innumerable variety and may be divided into two groups as follows.

I. Soft rubber and gutta-percha goods.

These articles are either of pure india rubber or else of india rubber mixed with other substances such as wood, metal, glass et cetera, or combined with hempen, linen, paper, woollen, jute and other textile fabrics. These goods are either: 1. articles employed in different branches of trade, such as belting, hose, hemp and waterproof sheeting, pump valves, buffers and carriage tires; 2. articles used in the sick chamber; 3. household utensils, such as pails, bags, sacks, photographic baths, mats et cetera.

These objects vary greatly in price; small articles of delicate workmanship made of quite pure rubber cost sometimes as much as 8, 9 and 10 roubles per pound; whilst commoner objects, not requiring to be made of absolutely pure rubber, cost far less; the mats for instance contain very little india rubber and sometimes do not cost more than 80 kopecks per pound. Valves cost about 2.50 roubles and syringes about 5 roubles per pound. The prices of soft rubber and gutta-percha goods depend far more upon the workmanship than the cost of the material, as for instance, balls, dolls and toys in general.

II. Horn rubber goods.

These articles are polished and made of pure horn rubber, or combined with other materials; they are principally physical, chemical, astronomical, surgical and electrical apparatus and ornaments for furniture. These goods are generally very light and of elaborate workmanship, so that their price by weight is very high, about 2 to 5 and sometimes 10 roubles per pound.

By recapitulating the foregoing statistics referring to the india rubber industry in Russia up to 1890, the actual state of the trade is found to be as follows:

India rubber manufactories, except Finland.	9	
Number of men employed	3,273	
Production of rubber goods	10,312,000	roubles.
Mean production per factory	1,145,777	»
Production per workman.	3,150	»
Import of rubber goods	287,114	»
Export of rubber goods	1,526,542	»
Annual home consumption	9,072,572	»

The export, here shown, exceeds the import by 1,239,428 roubles, or is 5.3 times as large, and amounts to nearly 15 per cent of the internal consumption.



CHAPTER VIII.

Wood Industry.

IN consequence of the abundance of timber in some parts of Russia, wood working has always been one of the most extensive industries, occupying large numbers of men and having an economical influence upon the life of the population. Dwellings, farm buildings, furniture, household utensils and agricultural implements are all principally made of wood in Russia, and therefore wood working is a well known trade to the greater part of the rural population, from time immemorial accustomed to handle the axe and other carpenter and joiner tools. Nearly the whole of Russia is studded with numerous village workshops, such as coach builders, coopers and carpenters, supplying the neighbouring and sometimes distant markets with their cheap and often excellent goods.

The greatest degree of development was naturally attained in those localities rich in timber; in some places where the forests are already largely consumed, the inhabitants still pursue their usual calling, the materials being obtained from other places. These cases are however rare as the village trades are mostly subordinate to the fundamental rural industry and the chief factors for determining the degree of development and future condition of the wood working trade in a given locality would therefore be the proximity of forest land, cheapness of timber and facilities of transportation.

In order therefore to arrive at a true understanding of the condition of the wood working industry in Russia, it is necessary to determine the degree of woodiness of its various districts. Great importance must also be attached not only to the general extent of forest lands, but also to that part of them which are under the direction of the Department of Woods and Forests, as being more thoroughly investigated, subjected to better cultivation, and, what is most important, sufficiently guaranteed from destruction. The following table, compiled from the latest statistics of the Forests Department of the Ministry of Crown Domains, shows the degree of woodiness of the different parts of Russia.

	Ratio of wood-land to total area of given region.	Total forest area in thousands of dessiatines.	Area of Crown forests in thousands of dessiatines.	Good forest soil in Crown lands in thousands of dessiatines.	Ratio of Crown forests to total forest area.
Regions:	Per cent.				Per cent.
Northern	71	84,696	81,355	64,832	96
Eastern.	45	41,557	23,495	18,729	56
Baltic-St. Petersburg	35	9,815	2,648	1,587	27
North-western. . .	31	8,715	2,303	1,779	26
Moscow Central. .	38	13,938	3,326	2,822	24
Central Chernoziom.	17	7,391	1,790	1,511	24
South-western . . .	22	3,387	793	672	23
Little Russia . . .	11	1,616	300	214	19
Southern	2	1,212	204	138	17
Vistula	22	2,484	789	759	32
Caucasus	19	6,914	4,355	2,971	63
Finland.	—	—	13,075	—	—
Siberia	—	—	106,929	22,808	—

The data referring to the amount of suitable soil for forests are only given for those woods under Government administration, where the extent of favourable soil amounts to 79 per cent of the total area of Crown forests. If this percentage be extended to all forests, then the whole amount of suitable forest soil in Russia in Europe, without counting the governments on the Vistula and the Caucasus, amounts to 136 million dessiatines.

According to this table the forests lands in Russia amount to 41 per cent and the suitable forest soil is expressed by $41 \times .78 = 32.4$ per cent. This last figure conveys the idea that Russia is a more richly wooded region than western Europe, which contains 28 per cent of woodland, Austria having 29, Germany 26 and France 16 per cent. Russia is however far too extensive to be regarded as a single element, and by dividing it into several separate regions and assigning the same proportion between favourable forest soil and total extent of forests as that given for the Crown forests, the following relations are arrived at. The northern region is found to be the most richly wooded, the forest land amounting to $71 \times .8 = 57$ per cent of the total area; the eastern region with a woodland area of $45 \times .79 = 36$ per cent, and the Moscow region, with $38 \times .82 = 31$ per cent, follow next. The remaining regions are poorer in forests than Germany; the north-western region contains $31 \times .77 = 24$ per cent, the Baltic-St.-Petersburg $35 \times .60 = 21$ per cent, the Vistula region $22 \times .96 = 21$ per cent, the south-western $22 \times .84 = 18$ per cent, the Central Chernoziom $17 \times .84 = 14$ per cent, the Little-Russian $11 \times .71 = 8$ per cent, and the southern region about 1 per cent. If therefore the northern and eastern governments be omitted, as they supply but little timber to the other parts

of the country, Russia is found to be a comparatively poorly wooded country and many parts of it contain even less forest land than France.

Another circumstance of considerable importance is that the area of the Crown forests amounts to 67 per cent of the total extent of woodland, and this has a very favourable influence in preventing the destruction of forests which greatly assist in developing the resources of the country. There is a marked disproportion in the distribution of the forests with reference to their proprietorship; thus it appears that by far the greatest quantity of forests in abundantly wooded districts are owned by the State, whilst in the more poorly wooded regions this ratio is far smaller. Taking the mean ratio as 67 per cent, Crown forests in the northern region amount to 96 per cent of the whole woodland area; in the eastern region the Crown owns 56 per cent, in the Baltic-St.-Petersburg 27, in the Moscow and Central Chernoziom 24, in the north-western 26, in the south-western 23, in the Little Russian 19, and in the Southern 17 per cent. Finland is one of the most densely wooded regions of Russia: in 1888 the crown woods alone covered an area of 44,285 hectares or about 13,075,000 dessiatines, which is 45 per cent of the total area of Finland.

For want of requisite statistics it is impossible to determine with any accuracy the yearly consumption of wood in Russia. According to Professor Arnold each inhabitant uses about one-half a cubic fathom per annum, and as the amount used for building is about one-sixth to one-fifth of the quantity consumed, it follows that each inhabitant requires about one-tenth of a cubic fathom per annum for building purposes, and the total consumption calculated on this basis may be estimated from 8 to 10 million cubic fathoms a year for building alone. It is necessary to add, that in Russia nearly all the villages are composed of wooden houses and that the people, who originally settled only in the woods, have up to the present time but little notion of the preservation of forests, and consequently the consumption of wood in Russia is abnormally large.

The most common and by far the most useful tree of the abietic or fir tree species, which grows in Russia is the ordinary pine, or *pinus silvestris*. It is found in more or less dense forests in at least two-thirds of the whole extent of European Russia. The next most familiar tree of the same variety is the fir, *abies* or *picca excelsa* which is found in the northern parts of Russia. Besides these the Siberian fir, *abies sibirica*, the larch, *larix sibirica*, are much prized in the north-eastern governments, and in Siberia, the Siberian cedar, *pinus cembra*, is one of the best trees.

Of the foliate trees the following need only be mentioned. The birch is the most widely spread and is found in several varieties, such as *betula alba*, and *betula pubescens*, in most parts of Russia. The aspen tree, *populus tremula*, is almost as widely diffused as the birch. The lime, *tilia parvifolia*, is likewise very common in Russia in Europe, and the oak, *quercus pedunculata*, grows in many parts of central and southern Russia.

THE WOOD-WORKING INDUSTRY.

Notwithstanding the great extent to which wood working is carried on in Russia, the industry is principally of a simple and manual nature, only adequate to the local requirements. Most of the timber is bought in logs or sawn into planks and

deals in the woods and factories, and never enters the mills, of which alone a record is kept. The sawmill trade is in a backward condition and gives no idea of the amount of timber consumed, or the money turned over in the business.

With reference to the foreign timber trade, it must be first of all observed that Russia has from time immemorial exported a great deal of wood from the north and west, mostly in the raw or half-trimmed state, the export of manufactured wood being comparatively small. At the same time, joiner and cabinet maker's work is being imported into the country, although not in large quantities.

	EXPORT OF LUMBER AND WOODEN WARES, EXCLUSIVE OF FINLAND.	
	1889.	1890.
	R o u b l e s.	
Oak beams	362,440	391,571
Pine ditto	7,389,9	8,165,489
Fir ditto	1,459,231	1,421,392
Various ditto.	428,769	723,046
Poles	272,994	196,404
Facings	9,066	10,665
Joists, rafters, trusses, battens	4,945,863	4,558,424
Planks, laths, sleepers, slabs.	35,724,534	32,562,817
Scantlings and shingles	34,624	26,365
Posts, axletrees.	590,710	988,941
Nut wood	228,332	198,917
Palm wood.	406,957	362,782
Small unclassified hard wood	3,444,388	3,687,141
Total export of raw and half-dressed lumber goods	55,297,812	53,291,954
Carpenter works.	75,493	102,316
Joiners works	243,213	284,171
Turners and wood carvers ditto.	28,906	61,175
Various unclassified manufactured wooden goods	229,090	435,674
Matting	122,996	138,646
Total manufactured goods	699,698	1,021,982

The export of raw and half-trimmed lumber from Russia has therefore of late years amounted to 55 million roubles; about 40 per cent of this has been sent to Germany; 33 per cent, to Great Britain; and 6 per cent, to Holland et cetera.

The export of manufactured wooden goods is less than one million roubles per annum. The export of timber from Finland is estimated in the statistical reports by the number of cubic metres and amounts to about 1,333,333 cubic metres of building timber and light stuff, exported principally in planks and deals. Taking the average price of a cubic metre of sawn timber at only 10 roubles paper, this export may be put down at 13 million roubles.

I M P O R T.	IMPORT OF LUMBER AND WOODEN WARES.	
	1889.	1890.
	R o u b l e s.	
Choice woods for turners and joiner work . .	341,916	497,092
Various woods in sheets and veneer	85,009	71,113
Carpenters work	364,177	335,566
Joiners and turners work	1,092,008	1,269,388
Unclassed lumber goods	4,541,908	4,698,801

Moreover, of late years wood pulp to the value of over a million roubles a year has been imported, also a like amount of resin which, considering the abundance of wood in many governments, might easily be manufactured at home, if only the wood industry were more developed in this direction. The statistics of the number of mills and manufactories engaged in wood working, and of their yearly production and number of workmen in Russia, exclusive of Finland, show a considerable development in wood working as a manufacturing industry. In proof of this it is only necessary to quote the figures for 1881 and 1891 in the following branches of the trade: saw mills, cabinet making and joining, turning and other various small work, mat making and wood-pulp manufacture.

	SAW MILL TRADE.			CABINET MAKING AND JOINERY TRADE.		
	Number of mills.	Production in thousands.	Number of hands.	Number of works.	Production in thousands.	Number of hands.
1881	516	15,418	11,319	154	2,584	4,424
1890	631	21,566	17,986	103	4,301	5,864

	TURNERY AND SMALL WORK.			MAT MAKING.			WOOD PULP.		
	Number of factories.	Production in thousands.	Number of hands.	Number of factories.	Production in thousands.	Number of hands.	Number of mills.	Production in thousands.	Number of hands.
1881	53	452	513	69	536	4,997	3	65	91
1890	62	1,371	2,739	78	482	5,532	19	521	437

The saw mill industry is evidently the most highly developed wood-working manufacture, most of the mills being of fairly large size, furnished with power usually generated by steam, and employing a comparatively large number of hands. Their united yearly production amounts to more than 20 million roubles, whilst the export of beams, rafters, planks and other kinds of sawn timber exceeds 40 millions per annum or double the production of the saw mills, the remainder as well as the enormous quantity of timber consumed in the country is sawn by hand and therefore does not enter into the production of the manufactories.

The Russian cabinet making and joinery works engaged in the manufacture of furniture, inlaid flooring, doors, frames, packing cases, barrels, billiard tables, shrines, mouldings, et cetera, contribute only a small proportion of the amount of these goods consumed in Russia, the remainder being supplied by artisans working at home in the towns and villages. There are certainly some large mills worked by powerful steam or hydraulic motors carrying on this branch of manufacture, but their number is comparatively small.

The same thing may be said with regard to the manufacture of small wooden wares, such as boot pegs, boxes, umbrellas, toys, wooden buttons, reels and shuttles for weaving and spinning mills, wheels et cetera. It must be however mentioned that the manufacturing trade in small wooden goods is increasing every year and has multiplied several times during the space of ten years. The production of wood pulp, which is of great importance to the paper trade, has also rapidly developed. It is worthy of note that the government wood-working manufactories serve as an example for the further development of the industry.

The military technical establishments, such as the admiralties, arsenals, artillery workshops et cetera, are furnished with wood working machinery of the latest construction, and the manufacture of wheels, boxes and other wooden articles for the artillery and other departments is conducted in the most rational manner. The carriage works and railway shops are also provided to a great extent with efficient machinery, several of them being complete wood-working manufactories, by no means inferior to many foreign ones. The match trade, which is rapidly developing in Russia, also requires a good deal of working machinery for the manufacture of the sticks and boxes in large quantities. The pattern shops of large foundries are provided with machines tools, also the coach building, pianoforte and other manufactories which will not be discussed in this article. Even those mills and factories which manufacture

goods of other materials often use circular and band saws, hand-fed planing machines such as the universal wood worker and others for making packing cases, sawing wood and other purposes.

In Finland the wood manufacture is developed to a considerable degree and its proportions are steadily increasing. Thus, in 1879 there were 244 saw mills, 63 steam and 181 water power, employing 6,128 men, sawing 3,892,676 logs and producing 439,830 cubic metres of planks, 348,065 cubic metres of barge sheathing and 17,015 cubic metres of other goods. In 1888 the number of saw mills increased to 314 of which 117 were driven by steam and 197 by water power and employing 7,045 men, cutting 8,186,157 logs and producing 597,173 cubic metres of planks, 791,885 cubic metres of barge sheathing and 89,782 cubic metres of other goods. The total production of the wood-working trade in Finland amounts to 12 million paper roubles.

The village wood trade is highly developed, and at present of great importance as it enables a considerable proportion of the population of the Empire to earn a livelihood without removing them from the soil or their homes. All the investigations, made with the aim of studying village trades in Russia, show that wood is the most suitable material for the village craftsmen; as there is hardly a government in Russia, however deficient in wood, where there are no village artisans engaged in making the most common household articles from wood.

On account of the great importance of the village trade the Government, scientific societies, technologists and other interested parties make every effort to improve the village handicrafts by organizing exhibitions, establishing suitable schools and removing all conditions unfavourable to its development, especially as the goods are not only remarkable for their cheapness and the national character of their design, but also eminently adapted to the particular requirements of the population. In consequence of the rise in the prices of wood in many places the Department of Woods and Forests issued a circular dated September 23, 1889, to all the administrations of Crown property permitting the sale of a part of the wood without bidding, not only to whole societies of peasants but to the separate groups of village craftsmen in order to enable them to acquire wood on easy terms, thereby supporting the wood-working trade in those places where there are not many forests belonging to private persons.

Almost the whole of Russia is dotted with numerous small wood-working establishments which generally make a specialty of one kind of work, which is often of an original character. In most cases the inhabitants of one village keep to the same style whilst those of another village manufacture a different article so that the class of work is rarely mixed in the same village. On the other hand the craftsmen of adjacent villages often subdivide the labour required in one and the same branch of the trade. Thus, in some hamlets of the Semenovsk district of the government of Nizhni-Novgorod the peasants carve out rough wooden spoons, whilst in another they are turned, and finally painted in a third, but not a single village or family turns out a finished spoon.

Once introduced into a given locality the wood-working industry generally clings to it, and if the wood in the neighbourhood becomes exhausted the artisans import it, even from afar. For purchasing their materials they generally unite into

strong corporations and send trusted travellers to buy or prepare the materials in distant places. The manufactured goods are rarely sold at home but most often taken to the fairs, where they are either sold directly to the consumers or to middlemen who sometimes dispose of them in distant places.

The wares of cartwrights and carriage builders are principally of the roughest description and remarkable for their cheapness. The colonist wagons of the Novorossisk district and the tarantasses of the Viatka district are however of excellent quality. In the village of Pogorelka of Shouisk district in the government of Vladimir the peasants manufacture 2,000 sledges made of juniper wood. In the districts of Khvalynsk and Kouznetzk, in the government of Saratov, the cartwright trade is highly developed and a quantity of carts, axletrees, sledges, wheels, tires and shafts are made. The village of Kontoshikha in the Valdai district of the government of Novgorod makes a speciality of wheels: the tires are principally bent out of the poplar, felled from August to March, as that cut in spring and summer is not strong enough for tires. Willow is also often used instead of poplar for tires, because they are better and stronger, so that wheels made with willow tires are the more expensive; nevertheless by far the greater quantity are made of poplar as thick willow is now rather hard to find. The naves of the wheels are made of birch, alder or likewise of poplar. Birch is the best wood for this purpose and next, alder. When ready, the naves are coated with hot tar to increase their strength. The spokes are principally made of mountain ash, sometimes also of birch; the former are preferred as they are stronger. A pair of wheels with poplar tires cost 1.50 roubles, and a pair with willow tires, 2 roubles.

It would be impossible to enumerate here all the villages engaged in the cartwright trade on a large scale, but one particularly Russian branch of the industry may be mentioned, namely the manufacture of *dougas*, (shaft bows) which is carried on in many places, one of the principal centres being the village of Kroutoi-Log in the Belogorodsk district of the government of Kiev, where it has existed for a very long time. In former times the Belogorodsk *dougas* were famous in the south of Russia and were eagerly bought up at the fairs. Later on when the railway lines brought about a decline in the carrier trade, the shaft bow business became slack and the demand for them in the southern fairs fell off so that new markets had to be found, such as Moscow and the regions beyond the Urals. These shaft bows are made of *cytissus* logs which are principally purchased from landed proprietors, and sometimes from peasants. It is curious to note that in some parts of the government of Koursk and in the border villages of the government of Voronezh and Kharkov the peasants are cultivating a special kind of tough *cytissus* to sell to the maker of shaft bows, and it seems to be a profitable undertaking as the wood grows rapidly and does not require much attention.

The cooper trade is as widely spread as that of cartwrights and has attained considerable development in the governments of Viatka, Riazan, Tver and Novgorod. In 17 villages out of the 21 in the Yasenovsk volost in the Vyshnevolotsk district of the government of Tver nearly all the peasants are coopers, who in the latter locality principally use fir wood, although utensils made of red pine are more expensive. They manufacture butter tubs at 5 kopecks a piece, kegs at from 8 to 10 kopecks according to size, double-bottommed wooden vessels, all kinds

of wash tubs, baskets of linden bark, all being about equally profitable, the daily work of each cooper being represented by goods to the value of 50 to 60 kopecks. After subtracting a few kopecks for material, the clear profit amounts to about 2 roubles a week. The village of Valtyrev in the Borovitchevsk district of the government of Novgorod also produces a large quantity of various utensils, such as tubs, ladles, kegs, pails et cetera, these goods being famed not only for their strength and neatness but even for their artistic designs. The pails at 20 kopecks a pair, and ladles at 5 and 10 kopecks apiece, are much admired with their juniper wood hoops and attractive appearance. The Valtyrev utensils are made of fir wood, brought down by floatage and purchased in logs on the river Msta at a distance of 5 versts from Valtyrev. A log, 3 sagues long and 5 vershocks thick at the top end, costs 75 or 80 kopecks and is sufficient for making 5 tubs 1 arshine high costing 65 kopecks apiece. Pine logs cost about the same as fir.

The wooden ware manufactured in Russia is of many kinds and many of the articles are necessary for the other village industries. Many districts, for instance, manufacture large quantities of reeds, the Pashinkovsk group of villages in the Egorevsk district of the government of Riazan alone produces as many as half a million birchwood reeds a year. In the government of Tver in the villages of Konshalin, Naidensk and Velshin there are about 240 households carrying on the trade. The reeds are made of wood, which is purchased in loads, of logs 1.5 arshines long. In a good load, costing 2 roubles, there is sufficient material for making 250 reeds. At the present time the middlemen pay from 5 to 20 kopecks per reed according to the make, but the average price is from 12 to 14 kopecks. The reed makers do not work more than six months in the year, and a man will make about 200 per winter. They are also made in the village of Okhlopkov in the Arzamas district of the government of Nizni-Novgorod and in many other places; they always meet with a ready sale as they are indispensable to the village weavers.

The production of spinning combs is also considerable and principally centred in the manufacturing governments, especially in that of Vladimir, although the maple wood out of which they are made is brought from the forests of Kalouga and often even from the western governments. In the Shonisk district more than 250 men are engaged in making these combs, the yearly production being about 70 pairs per workman. Spinning wheels are made in the Medynsk district of the government of Kalouga and the local sheepskin dressers, of which there are about 10,000 men, when setting out to work in the Crimea or the Caucasus, take a large number of spinning wheels with them in pieces. The skillful artisans of the village Velikoe in the district of Yaroslav are famed for their spinning wheels; their production amounts to over 1,500 wheels a year. The manufacture of weaving looms is also carried on here and in many other places. In the village of Leytnevo in the Shouisk district there are twenty-five households engaged in the manufacture of harrows, their production amounting to 3,000 pieces a year: they are made of fir wood, with juniper rings and oakwood teeth.

Wooden packing cases form one of the principal specialities in joinery; they are generally made of alder wood, on account of its lightness, and are much used for packing goods to be sent to the far East. To facilitate the transport of the empty cases, they are usually made of different sizes to fit into one another. The

principal centres of the packing case trade are the Makarievsk district in the government of Nizni-Novgorod, the Bagrationovsk villages in the Mouromsk district of the government of Vladimir and also the Verkhotoursk and Ekaterinburg districts, of the government of Perm.

The manufacture of bent cherry furniture is carried on in the Kosmodemiansk district of the government of Kazan: the material consists principally of sticks in the bark about one-half to three-fourths of an inch in diameter, and 2 to 3 arshines long; the wood generally comes from a distance and costs at present about 35 kopecks per hundred pieces on the spot. One chair takes 25, and an arm chair, about 30 sticks. These chairs made to order cost 6 roubles a dozen and the arm chairs, 80 kopecks to a rouble apiece; footstools, sofas and tables are also made there. This furniture is made in a very simple way; the fresh cherry sticks are pared with a knife and then carefully bent across the knee; when properly curved the stick is tied up with bast and put away to dry, after a short time, the bast strings may then be removed without fear of the sticks straightening out again. Before being bent they are always stored in a damp place; any sticks which may have become dry require to be steamed or steeped in water before they can be used. The rods which are gathered in June and August are generally discarded, as when peeled they do not turn yellow, and the furniture which acquires the deepest natural yellow tint is most prized. The seats of these chairs are made of thin oakwood boards. The production of this district amounts to about 1,100 dozen bent cherry wood chairs a year, of which about 500 dozen are sent to Moscow and the remainder sold in the towns along the Volga. In the government of Viatka there are as many as 600 village joiners with a united production of 140,000 roubles. Their wares consists of boxes, frames, cases and many other articles, the furniture being worthy of particular attention, on account of its handsome appearance, strength and cheapness; the chairs are particularly cheap the painted ones being sold as low as 9 kopecks apiece.

In many parts of the government of Moscow the village artisans make carved furniture which in artistic design and quality can compete with the best goods of the kind. This furniture finds its way into the hands of the middlemen in Moscow who put foreign trade marks upon it and pass it off as imported goods.

Carpentry is not such a popular trade among the village workmen; there is however a considerable business done in window frames in the villages of Pourekh and Gorodets in the Balakhninsk district of the government of Nizhni-Novgorod, also in the districts of Syzran in the government of Simbirsk, of Gorbatsovsk in the government of Nizhni-Novgorod and Kotelnichesk in the government of Viatka, and especially in the village of Gadovka in the Simbirsk district, whence the goods are conveyed as far as the Caucasus, the Don, Orenburg and Siberia. Wooden doors for cottages are made in the Kassimovsk district of the government of Riazan and the sale of wooden cottage walls is also often carried on here. In the village of Tseliava consisting of 20 homesteads in the district of Borovichi, almost all the peasants are engaged in the making of canoes of poplar wood; these boats, 12 vershocks thick and 3 sages high, carry 6 men and cost from 5 to 6 roubles. The inhabitants of the large village of Radoul, situated near the Dnieper in the Gorodnitsk district also occupy themselves with boat building in connection with their usual calling of float-

ing timber down the Dnieper, which occupies all the able-bodied men of the locality during the summer months, so that they are only able to devote their energies to boat building in winter.

The manufacture of wooden spoons is worthy of particular attention and is concentrated principally in the Semenovsk district of the government of Nizhni-Novgorod; the chief material used is birch, and small quantities of poplar, maple and palm, the latter three being imported. In the Semenovsk district this industry occupies 7,000 men. A load consisting of one-tenth of a cubic fathom of birchwood is sufficient for making 400 spoons, and one man can make 800 pieces per day; the total production attains the enormous figure of 126 million spoons a year, necessitating the consumption of 30,000 cubic fathoms of birchwood. The spoons are sold from 6 to 8 roubles per thousand. All the goods are sent to the village of Gorodets on the Volga and thence to Nizhni and Irbit, penetrating as far as Persia, Khiva, Bokhara and Khokand.

Small wooden goods are made in great quantities and often with considerable perfection, although the rougher class of goods are more important being produced in greater quantities. Child toys are made in the village of Bogorodsk in the district of Alexandrovsk in the government of Vladimir and the neighbouring settlements, 600 men being engaged in the trade. The parish of Petropavlovsk in the government of Viatka is noted for fine wood carving; a good deal of small turnery of different kinds is done in the districts of Shadrinsk and Ekaterinburg in the government of Perm, in the Zvenigorodsk, Bronitsk districts of the government of Moscow.

In the Kstinsk, Troitsk and Pomzinsk villages of the Viatka district the peasants turn out as many as 30,000 pipes, 15,000 pipestems and 10,000 candlesticks and saltcellars. Pipes are also made in large quantities in many colonies in the government of Saratov, about 250 men being engaged in the trade; the maple wood used for this purpose comes from the regions beyond the Volga.

Counting machines (*schety*) are made in the Veraysk district in the government of Moscow, about 30,000 of them are sent to the Ukraine fairs alone. Since 1884 wooden mosaic work in tables and boxes has sprung up in the village of Maklakovo in the Vasil'soursk district of the government of Nizhni-Novgorod, the whole of the village being engaged in the trade, which has now reached a highly artistic state of perfection. Most of the mosaic workers of the village of Maklakovo use wood artificially stained in various colours in default of naturally coloured varieties, and this of course diminishes the intrinsic value of their work. About 10 of them however work in naturally coloured woods which they obtain with some difficulty, and at rather high prices, from a joiner in Nizhni-Novgorod. These different coloured woods are principally made up of old cigar boxes or the cases in which paints, groceries and other articles are brought from abroad.

The district of Tula is famed for the manufacture of concertinas, the work being divided among at least seven distinct classes of artisans. This industry has been in existence about half a century and the production averages about 240,000 instruments a year; they are sold in Moscow, Nizhni and the Ukraine; the recruits buy a large number, and the Armenians, Persians and Bokhariots are likewise very fond of them. Concertinas are also made in the Viatka, Orlovsk, Kotelnichetsk and

Malmyzhsk districts of the government of Viatka. Very fine toned instruments of this kind called fis-harmoniums, with as many as 22 notes, are made in the villages of Istobensk and Khlimovka; they cost about 40 roubles and the Viatka merchants sell them as foreign goods at 150 roubles apiece. Organs and violins are made in the village of Velikoretsk in the government of Viatka.

Very original and quaint looking objects are made from the excrescences of birch which have a very pretty undulatory or veined section with a pearly or rainbow like lustre. The excrescences of the birch trees alone are used as they are the toughest and most beautiful, and also the most easily worked. These goods are only made in considerable quantities in two places, one in Slobodsk and the other at Viatka. The hinges made whole for box lids and cigarette cases are very curious and are much appreciated at home and abroad by amateurs of this peculiar kind of carved wooden work, which is also remarkable for its cheapness.

The basket-making trade is considerably developed in many parts of Russia. Quantities of baskets are made of willow twigs in the Tauride, Tver, Kazan, Kiev and other governments; in many other places, as for instance, Strelitsa in the Vessieghonsk district of the government of Tver pine splints are used for the purpose. This industry is frequently met with on the banks of the Dnieper in the government of Kiev, and as a supply of willow twigs can be obtained without much difficulty and the baskets are in great demand for transporting the local garden produce, the trade is very likely to thrive and is quite in accord with the character of its surroundings. The willow groves along the banks of the Dnieper are regarded as the common property of the peasants, and the rural authorities do not demand any payment from those who collect the boughs, but at the same time exercise strict control over this precious raw material, forbidding it to be cut during certain periods of the year and posting keepers round about it in summer, charged to watch over the interests of the community. The gathering time on the meadows and islands by the Dnieper generally commences on the 15th of July, when all the basket makers of the district set out to cut boughs, which they immediately peel and tie into bundles, each man being able to cut and peel about 3 to 4 thousand pieces per day. These sticks are then taken home, placed in rows, dried in the sun and put away in barns or storehouses. The basket makers, principally women and lads, are able to make about 4 large baskets a day, and earn about 30 kopecks. The trade is principally located in the villages near Kiev, but is rapidly spreading to other parts. The production of the basket-making industry in the government of Kiev is not only sufficient for conveying fruit to the northern parts of Russia but also for supplying the government of Bessarabia for the transport of garden produce.

Baskets are also manufactured of pine splints in the village of Ilmovits in the government of Novgorod. These splints are chipped from the butt logs, 12 or 13 quarters long, cut from 2 to 4 vershock pine trees, felled in woods belonging to the peasants. The butt logs are used, as they give clean wood free from knots, and small sized trees are selected as the larger sizes are used for building purposes, and would be too expensive for basket making. As soon as the logs are brought from the woods they are split into four pieces and rived while fresh into splints. One 4-vershock log, 13 quarters long, is sufficient for making 6 baskets

1 arshine high, 1 arshine in diameter at the top, and three-quarters of an arshine square at the bottom. A 2-vershock log of the same length will make 2 such baskets. They cost 20 kopecks apiece. Linen baskets 1 arshine long, 6 vershocks wide at the bottom, and 12 vershocks at the top cost from 7 to 10 kopecks. In many parts of the government of Viatka very elegant baskets, vases, sugar basins and other articles are made of the roots of young fir trees. Besides this, fishing and hand baskets are made there of straight willow shoots, also flat baskets for carrying fuel, snow, manure and refuse, are made of willow branches and young stems, also tarantass and sledge frames of thin cherry stems.

The preparation of lime bark is a peculiar and considerable industry, especially that of the internal or bast layer. Stems from one-half to one and one-half vershocks thick are used for making lime bast. They are felled in spring, in the sap, and the bark is removed by means of an iron hook; the outer layer of bark is peeled off with a knife and the soft, thin bast is cut into ribbons one-half a vershock wide. The work of stripping the lime bast is generally done in the woods, but sometimes the peasants take the stems home and strip off the bark in doors. The stems are sometimes, although rarely, cut in winter and are then steamed in the warm cottages. The lime bast is tied into bundles for sale and sold by the bundle, which generally contains 60 pieces or sometimes 100 of the finer or only 30 of the coarser sort, although such a half-bundle will cost more than an ordinary one of 60 pieces. The pieces are mostly 3 arshines in length; longer pieces are rare and are sold singly. The lime bast is used for platting shoes; each pair takes 12 pieces and as each sapling only yields 3 or 4 pieces every pair of shoes requires 3 or 4 saplings. These shoes are worn by most of the inhabitants of northern and eastern Russia, so that the consumption of lime bast is indeed enormous. The greater part of these shoes are made at home by those who require them, and for the most part by the oldest members of each peasant family, incapable of any other work. Sometimes, however, this industry is concentrated, as for instance, in the village of Smirnov in the Ardatov district of the government of Nizhni-Novgorod where about 300 men are exclusively engaged in it; each man is able to make 400 pairs in a winter. The goods made by the peasants of the villages of Nouchi and Ouzhovka in the same district are sent to the governments of Tula and Voronezh. The village of Semenovsk near Kineshma manufactures 100,000 roubles worth of bast shoes, which are sold over all Russia. The lime bast trade in the Mordos villages in the Shouisk district is very considerable as from one settlement alone, called Myt, 500 thousand pairs of bast shoes are sent to Moscow. Other lime bast goods, such as boots and hats, are manufactured in the government of Kazan where the village workmen are noted for their great skill, their goods being bought up very readily on the local markets.

The larger sized trees are taken for making bast wisp. For this purpose they are felled in late spring or early summer when the warmth of the air and the juiciness of the cambium tissue facilitates the removal of the bark. The tree is felled and placed across two logs, circular incisions are then made in the bark at a distance of $6\frac{1}{4}$ arshines apart, the usual length of the bast wisp. Longitudinal incisions are then made in each division and the bark is removed either by hand or with a sharp wooden trowel about two vershocks wide. One man is able to strip

15 trees per day, while a second removes the bark to the steeping place. The transport takes place in summer through unfrequented, roadless places often encumbered with wind-felled trees and other timber, and cannot therefore be effected on wheels, but by means of trucks composed of two small fir trees inserted into a block of wood with their ends raised and joined in the middle by a cross piece. The horse is attached to them as if to shafts and the bast is loaded crosswise. The steeping places are the woodland rivulets, lakes, gulfs and even deep ditches in the marshes. For transport the smaller tubular layers of bark are placed inside the larger ones, making rolls of 3 to 6 pieces. These rolls are plunged in water and the bark is allowed to steep for one and one-half to three months, according to the temperature of the air, and the thickness and size of the bundles. The steeping separates the outer layer of bark and softens the bast, which parts with its viscous matter and resolves itself into threads or wisps. This process is very important and care must be taken to select a suitable spot, that is, a warm and abundantly watered place; dams have even sometimes to be made to preserve the water in the heat of summer. When removed from the water the bast is laid on the bank with the bark downwards, cleaned with a swab and washed. The bast may be then separated without difficulty by hand, although some skill is required; it is then put to dry on stakes in the woods and taken home before the commencement of winter. One medium sized lime tree, about 4 vershocks thick and 4 sagesnes high, will yield about 15 pounds of bast wisp; working 2 months in felling and steeping, one month in removing the bast from the steeping places and one month in transport, two men with one horse will make about 280 pounds of bast wisp.

This material is principally used for weaving matting and sacks, in special looms which the peasants erect in their back premises; these looms are provided with reeds consisting of rows of flat wooden teeth inserted between straight wooden boards. Two men are occupied in weaving whilst a third separates the wisp into narrow ribbons and sorts it into the weft and the warp which latter is made of the best kind, that is, the long, thin and tough ribbons; three men are able to weave 20 mats or 15 sacks sewn together in a day. The mats are of various kinds, depending upon the place where they are made; one pound of bast wisp will produce from 5 to 12 mats according to size. The sacks are made in three sizes, heavy sacks holding 9 pounds of rye flour, light sacks, holding 5 pounds, and medium sacks; one pound of raw material will yield from 5 to 7 sacks.

The bast wisp industry in Russia is very large; in the government of Viatka alone about 500 thousand trees are felled for this purpose and 900 thousand sacks and 600 thousand mats are produced with a total expenditure of 340 thousand working days. The Vetloujsk and Varnavinsk districts in the government of Kostroma produce 100 thousand pounds of bast wisp occupying 700 men during a period of 4 months; besides this, 650 men are employed in making mats and sacks. The shangsk mats, of the Louginin make, are the most celebrated and are even known in England. About 200 thousand pounds of bast fibre is made in the Ufimsk and Birsks districts of the government of Ufa. No less than 200 thousand mats and double mats are manufactured in the government of Penza; in the Kochkourovsk and Giropinsk bailiwicks in the Loukoyanovsk district, 500 sacks are manufactured for Morshansk. The chief trade of the inhabitants of that part of the Makarievsk district which lies

beyond the Volga in the government of Nizhni-Novgorod consists in the manufacture of bast fibre goods for the traders of the settlement of Lyskov. A good deal of bast fibre is prepared in the government of Minsk for Riga.

The coarser kinds of bast fibre and lime bast are used for making tackle for rafts. On the Vetlougá alone 15 thousand pounds of bast fibre are used for 1,500 rafts. Lime bark as well as bast fibre is used for roofing, generally in pieces 3 arshines long, which are used for covering boat cabins and also for making hampers or cases, almost all drapers goods in Russia being kept in such boxes; Riga receives this material from the western governments; the Moscow market is supplied from the Veraysk district, the Shouisk district makes them at home. In the Vejsk district in the government of Vitebsk a large quantity of round boxes are manufactured; in the government of Kostroma alone 50,000 bast baskets are made. Bast is also used in large quantities for making sieves in the government of Kalouga. At Zimenchina in the Kovrovsk district of the government of Vladimir 500 men are engaged in making bast sieves; their production amounts to 1,500,000 pieces per annum; the raw material comes from the governments of Nizhni-Novgorod and Tambov.

In general the manufacture of this class of goods is located in particular centres at a distance from those places where the raw material is produced. Thus in the village of Grigorovo in the Melenkovsk district of the government of Vladimir there are 300 men engaged in weaving mats of imported bast fibre. The Orlovsk district of the government of Viatka which does not possess any lime trees, has distanced all the other districts in the mat and sack trade and works up 85 thousand pounds of bast fibre, part of which is conveyed to the fairs of the village of Onuy from the Malmyisk and Glasovsk districts and from the government of Perm, and the remainder is floated down the river Viatka from the Menzelinsk district of the government of Ufa.

THE PITCH AND TAR INDUSTRY.

The distillation of tar is one of the oldest trades in Russia and is up to the present time centred in insignificantly small establishments where the owner is at the same time workman and salesman. The production of these works varies from one to three thousand roubles a year; larger works are rarely met with, and there are very few indeed which have a production of more than 15 or 20 thousand roubles a year.

Even in ancient times the products of the pitch and tar industry not only sufficed for the internal requirements of the country, but also for export; thus when Novgorod belonged to the Hanseatic League, pitch was an important item in the export trade and was obtained from the northern appanages of Russia. At the present time pitch is principally exported to England from Archangel where it is one of the principal articles of trade; turpentine is sent to Germany from the Baltic ports and overland. Of late years in the western governments and those by the Vistula large quantities of pitch and turpentine are distilled from the stumps left after the clearance of woods. This turpentine is in great demand in Germany on account of its good quality and cheapness.

Pine wood is almost the only material used, the most resinous parts being the stump and roots. In order to facilitate the uprooting and increase the resinous quality by decomposition the stumps are allowed to remain some 10 or 20 years in the ground before removal, and the best parts of the tree are the long vertical roots. The roots are dried in the air or even in special drying rooms, as it is a well known fact that the products are not of such good quality when damp material is used. When using the trunks of trees the distillers readily select those parts which are accidentally filled with resin especially where the fungus *æcedium pini* has injured the tree and produced an amassment of resinous matter. Not very long ago, even in the government of Vladimir, they used to fell a tree in order to obtain one resinous log, but the increased cost of wood has rendered it unprofitable to use timber in this way for distillation. Rotten old fallen trees are also used, and these may be of great value, if they are of ancient growth as is the case in the woods of the Sarovsk desert in the government of Nizhni-Novgorod. In order to increase the resinous qualities of the wood it is the custom in the governments of Archangel and Vologda to strip the pines; this is done by tearing a strip of bark 2 or 3 arshines long from the growing tree, first on one-quarter of the girth, and the following year on the next quarter and so on, in consequence of this the tree continually dries up and resinous matter abundantly comes out of its wounds; this is scraped off in the form of white resin or wax and the lignin is used for distillation.

The products of dry distillation are various, the most important being tar, an oily liquid consisting principally of a solution of pitch in turpentine, oil and creosote. The further treatment consists in separating the bitumen from the volatile oils. When distilled the pitch remains behind in the form of a hard body and the volatile oils carrying over a portion of the resinous matter condense in the cooler in the form of turpentine, red, yellow or white, according to its degree of refinement. The latter is obtained by completely eliminating the tar, but the creosote cannot be entirely removed and therefore the best colourless turpentine has a disagreeable smell. Turpentine without any odour can only be made from white resin. The hard product, corresponding to pitch in the distillation of tar is colophany or common rosin. Russian colophany, being carelessly prepared, is not of good quality and therefore instead of supplying this article to other countries, a considerable quantity is imported, as the development of the soap boiling and paper making trades necessitates a large consumption of it. Of late years, however, serious attention has been given to the proper way of making rosin. In 1872 the Department of Appanage, recognizing the importance and utility of this branch of trade, organized extensive works in the district of Velsk, government of Vologda, where especial attention was given to the production of tar. There is no doubt that owing to the introduction of such regular methods of collecting tar in the forests of northern Russia, and since the production of rosin has been founded on more rational bases, foreign rosin will not only be thrown out of use in Russia, but later on will even be replaced by the home product on the foreign markets.

The rosin produced from tar is a liquid, called *sourovitsa*, or tar water. From this liquid *metilov* spirits and wood acetic acid are produced, more frequently the latter. Wood acetic salt is fabricated not only in large chemical works, but in

Yaroslav and other governments it is an industry of the people. In the district of Kineshma, government of Kostroma, there are about 30 small peasant fabries, where wood powder (dry acetic lime) is produced from wood acid by a process of dry distillation of birch wood. The manufacture of wood acid has greatly developed since the industry began several years ago, as much of this acid is used in the chintz manufactories. The product is prepared according to regular and scientific methods and is therefore of good quality.

As to the technical means used for producing tar they are, in many localities, very primitive: the tar is burned in ditches dug in the earth, and very often much of the tar serves at the same time as fuel. Little by little more improved methods are adopted, namely, the *korchazhni* (earthen pot), the *kazani* (kettle), thus giving the name to the processes. In former times earthen pots, set in the ground, were used, and later, iron kettles set in the ovens came into use. The latter has become the predominating method at the tar works, although it is often replaced by another, where tar is produced in kettles of sheet iron, set at different angles in the ovens.

Although the tar industry is almost exclusively in the hands of the peasants, nevertheless, it has shown great improvements in recent years in technic, in the construction of the apparatus and condensers, as also in other economic processes, among which may be mentioned the use of other material for fuel, especially coal. This development has been attained by the peasants themselves, as learned technologists have paid little attention to the tar industry.

Still more independent is the occupation of making pitch, an industry that is especially Russian. In spring the thin upper bark is stripped from birch trees, either when the trees are standing or after they are felled; by means of distillation in simple apparatus, in many places by burning the wood in ditches, pure pitch is produced. It differs from tar by the complete absence of turpentine, contains less creosote and much more paraffine. As birch bark is much dearer now, pure pitch cannot be used for greasing leather and for other home necessities. Therefore, the Russian peasant has invented another surrogate as a substitute in leather dressing, which differs very little in its exterior from pure pitch. It is called *polovinchik* (half-pitch), and is produced through distillation of tar mixed with some birch or aspen bark. This product has lately attained great development, especially in the forest regions of Russia; thence it is sent to the steppes and is called *degot*.

The statistics of the tar industry are rather complicated. It is estimated, however, that the Russian forests produce yearly about 4,000,000 pounds of pure pitch and of *polovinchik*, about 2,000,000 pounds of tar, 150,000 pounds of resin and 60,000 pounds of turpentine, to the value of 8,000,000 roubles, including the charcoal, produced at the same time. This industry consumes yearly about 320,000 cubic sagesnes of stumps and roots (*osmol*), about 100,000 cubic sagesnes of wood and 2,000,000 pounds of birch bark, so that the total consumption of wood amounts to 600,000 cubic sagesnes, that is, the yearly growth of 1,500,000 dessiatines of forest.

CHAPTER IX.

The Metal Industries.

THE manufacture of articles from metal for the trade has been a prominent industry in Russia for many years, even antedating the reign of Peter the Great. This statement is confirmed by the fact that many articles bearing inscriptions have been preserved to this day, as well as by many written documents, amongst others the court rolls. Thus, the fabrication of bells began in Russia soon after the introduction of christianity. The forging of side arms of different sorts should be classed among the most ancient, and was especially developed during the civil wars between the Russian princes and frequent wars with nomads and Tartars. Finally, owing to the Russians being a very religious people, who in their most happy as well as most unhappy moments were always building churches and decorating them, the industry of making church ornaments and ikon trimmings of precious metals also dates from very ancient times. At the end of the seventeenth century this industry attained such development that Peter the Great found it necessary to stamp silver and gold fabrications, in order to protect their quality.

But the small quantities of gold and silver, as also of other metals, of which the principal are copper, iron and steel, produced by Russia, retarded the free development of these manufactures, centralizing them principally near the Imperial palaces, as all the metal produced in Russia, and imported, was taken there to be stamped. Thus Moscow was the principal centre of the Russian metallurgical industry before the reign of Peter the Great; the best gun makers and goldsmiths were there; amongst them were many experienced foremen who came from abroad under special invitation and inducements of the Government.

During the reign of Peter the Great, namely, from the beginning of the eighteenth century, the metallurgical industries attained a remarkable development, owing to the genius and interest of that great Emperor. He founded several metallurgical manufactories especially iron works, the principal locality for such being the Urals, rich in extensive veins of different metals, and in large areas of forests of fir trees,

which gave charcoal, especially suited to metallurgical purposes. The most ancient factories were those of Neviansk and Kamensk, situated in the district of the Urals, government of Perm, the first being founded in 1699, and the second, in 1701.

Furthermore, for supplying the wants of the army, Peter the Great organized similar works at the other extreme of Russia simultaneously with the founding of St. Petersburg, and in the same vicinity; these manufactories were the Sonoyarsk, founded in 1704, in the government of Viborg, and the Konchozersk, in 1707, in the government of Olonets. In 1719 iron works were founded in Istia in central Russia, namely, in the government of Riazan. It must be observed, however, that in the central and northern parts of Russia, as for instance, near Tula and Veliki-Oustug, already in the sixteenth century iron was fabricated from veins in the so-called *doushnitsi*, by means of hot blast and mixing the vein with coal and flux.

The Urals which, till the beginning of 1870, were the principal points of the different metallurgical productions, have always been the chief source of metal supply for the different trades, which were grouped in the localities, more or less in the near vicinity. The rivers Kama and Volga served as natural routes to convey the Ural metals to the central governments of Russia; therefore, many of the metallurgical industries, chiefly of a household character, have taken root on their shores. The fair of Makarievsk and later on, that of Nizhni-Novgorod, which were the collective points and trade centres for the sale of Ural metals, had also a great influence on the development of many industries in localities adjoining them by convenient ways of transport.

The present Russian metallurgical industry can be divided into two groups which differ greatly one from the other: the first belongs to manufacturing and the second to home industry. The latter occupies as to its production a very considerable place, notwithstanding the fact that its technical work is generally by hand; it can, however, compete with some of the products of the manufacturing industry, as some of its articles designed for sale are of excellent quality and workmanship.

The reason of the above fact lies in the conditions of the life of the Russian peasants. Possessing land, which is the principal source of their sustenance, they and their families give all the care possible to farming and their spare time only is devoted to some trade. The long winters, especially in central and northern Russia where the different industries are mostly centralized, have a great influence on the development of the home trades. After long and varied experience in working during the winter season the peasant becomes very skillful at his trade and turns out various forms of hand work very rapidly. When the peasant comes to fix the prices of his wares, he takes into consideration principally the cost of the materials adding thereto the cost of his living and a trifle only for his labour and time spent in their manufacture. In the sale of his articles he earns somewhere from 1.50 to 2.50 roubles, and rarely 3.50 per week. By making door and cupboard locks, the expenses for the material, of a Tula locksmith, form a little more than half of what he earns, and one-tenth for mending his instruments, so that his gross profits are only two-fifths of the value of the article. Although such conditions cannot be considered as very favourable to the producer they still not only uphold the domestic industries but also aid the manufactories by producing articles in a half-finished condition.

The money which the peasant earns in this way improves the conditions of

his life and gives him supplementary means for paying the taxes imposed by the Zemstvos and the Government. Therefore the Ministry of Domains takes all sorts of measures to sustain and improve these domestic industries. These measures, which consist in the collection of good samples of the different trades, in facilitating the means for producing raw material and in the establishing of regular agents between the producers and the wholesale dealers in these manufactures, in order to do away with the pressure of the middlemen, have a very favourable influence on the home artisans as well as on the industries themselves. Trade schools which are being constructed at the present time, and which will contain drawing classes, will also tend much to the improvement of the domestic industries.

In order to facilitate the description of the metallurgical industries it is necessary to divide them into sections, as follows :

1. Products of the noble metals and jewelry.
2. » copper and copper alloys
3. » lead, zinc, tin and their alloys.
4. » smithcraft and in sheet iron.
5. Cast iron and steel.
6. Artillery arms, guns and implements.
7. Side arms and cutlery; instruments for working different materials; scythes and sickles.
8. Wire and wire manufactures.
9. Locks and the different productions of the locksmith.

It is quite impossible to define the dimensions and cost of the productions in metal manufactured in Russia as the statistical informations on the domestic and manufacturing industries are not yet ready, although the Government has paid special attention to this question. As to the data which the Ministry of Finance has given on the manufacturing and large trade industries, to which belong such establishments as contain more than sixteen workmen, it must be admitted that they are also incomplete owing to the manner in which these statistics have been gathered. Besides, some manufactories and fabrics which belong to one owner and not incorporated, and therefore not obliged to publish their reports, as well as some trade establishments, generally return their data too low, from fear that additional taxes may be imposed upon them. Therefore, the official figures published in the different parts of this survey of the cost of the different productions must be considered in general lower than the fact. In the same way the definition of the cost of some domestic industries must also be considered only approximate, as the data were based upon material in hand, more or less imperfect.

PRODUCTS OF THE NOBLE METALS AND JEWELRY.

The working of articles in gold and silver in Russia dates from very ancient times. The industry was more or less prominent in pagan times but became especially developed since the introduction of christianity, when gold and silver wares

attained a definite style in designs and in the character of workmanship. The improvement in gold and silver wares began with the Byzantine artists who came to Russia and left very decided traces of their influence on the character of the Russian designs, which are still very similar to the pure Byzantine types. Although the German artists, who later on came to Moscow, made great changes in these designs, still the fundamental character of the Byzantine style has not lost its predominating influence. The Byzantine has been reproduced in a whole mass of articles made during the last fifty years by the best Russian silversmiths.

The working of jewels came to Russia much later, namely, in the sixteenth century. It began in Moscow, which owing to its being the residence of the Court and grandees, was the principal centre of silver, gold and jewel works. Thus, in the beginning of the eighteenth century, according to some documents which have survived, there were in Moscow 43 goldsmiths and 232 silversmiths, amongst them were jewelers.

Only in the middle of the eighteenth century gold and silver fabrics were organized in Russia; these fabrics had a certain constant number of workmen in them and articles in gold and silver were prepared not only to order, but as other market merchandise. Well organized workshops with a considerable number of workmen were established at the end of the last century and the beginning of the present. The principal of these founders is Sazikov who built his factory first in Moscow and later on in St. Petersburg.

Owing to the choice of good models, to the careful execution of the designs of good artists belonging to the fabric and by others, and to the excellent finish of the work, Sazikov became celebrated not only in Russia but also abroad. The *repoussé* works done by him always attracted the attention of experts and amateurs by the force of their relief. Mechanical apparatus and steam motors were first introduced in the Sazikov's factory at St. Petersburg, where latterly 75 workmen were working and producing articles to the value of 150,000 roubles. Unfortunately this exemplary silver fabric had to be closed in 1880, after the death of the director. However the workmen who had long served there were very useful from their knowledge and experience to other fabrics; some of them even opened their own workshops and took orders from silver stores.

The enamelling of silver was very little known until about 1850, and the work previous to that time was imperfectly executed. This art began to be developed owing to the Moscow manufacturer Ovchinnikov who founded his establishment in 1845. Later on he opened at his works a school with practical classes of drawing and of the science of silver art. He produces articles for the sum of 300,000 roubles yearly, works 120 men and is now the first silversmith in Russia. Next come Khlebnikov and Postnikov, both also great manufacturers of fine enamelled silver goods, with their own factories in Moscow.

The jewelry industry is principally centred in St. Petersburg and Moscow, where it has numerous representatives who possess well organized factories. Some of them use mechanical apparatus, especially stamping machines, for the manufacture of more ordinary articles.

Silver and jewelry industries bear also in some localities a domestic character which was especially developed and attained great proportions about the thirties, in

the government of Kostroma, along the borders of the Volga in the village Krasnov, which is the centre of the trade, and partly in the village Sidorovskoe and in 50 others which adjoin it. The peasants of some of these villages do not at all occupy themselves with agriculture and consecrate their whole time to the silver and jewelry industry. The articles manufactured by these peasants are sold over all Russia, not excepting the capitals, by middlemen who get them very cheap from the peasants and sell them at great profits on the markets. A great many of these articles go to the Balkan countries, as also to Persia and Central Asia.

The productions of the Kostroma peasants amount to the sum of 700,000 roubles yearly. They consist not only of silver articles but also of those in copper and latten which are sometimes gilt and sometimes only covered with a hard varnish; all these are made by the same smiths and are therefore included in the same category. An enormous quantity of articles is made for the above-mentioned sum, if it be taken into consideration that silver earrings with small turquoises are sold for 40 kopecks per pair and with artificial stones and strass, 23 kopecks, silver brooches, 75 kopecks to 3 roubles per piece, and latten rings, 7 kopecks each. In general articles in silver are prized for sale at 33 to 35 kopecks per zolotnik.

The price of latten articles is still more astonishing; thus for example, crosses, a thousand pieces of which weigh two pounds, are sold at 40 to 50 kopecks per pound, rings weighing three-quarters of a pound per thousand are sold at one rouble per thousand, and if they are gilt, at 10 roubles per thousand; earrings with beads or stones, 15 roubles per hundred, and simple earrings at 2.50 roubles and so on.

Investigations show that in the above region more than 15,000,000 pieces of different articles from silver and latten are made yearly. These consist of earrings, rings, brooches, bracelets, lockets, chains and neck crosses, the greatest number of which form silver, latten and copper rings. In both regions, Krasnoselsk and Sidorovsk, more than 3,000 men work at these articles. This work is considered very profitable although the pay to workmen is very low; thus for example, for the making of a hundred rings, the workmen receives 2.70 roubles and for the same number of brooches, lockets and pairs of earrings, 6 roubles. It must be taken into consideration, however, that crosses, earrings, brooches and lockets are made with the aid of hand stamps.

It should be noticed that all copper articles the workman must return to the merchant, who orders them by number, and silver wares exclusively by weight, together with the waste and filings. If there is some material wanting, the cost of it is deducted from the earnings of the workman, who receives for making simple articles 6 kopecks per zolotnik.

The agents and the merchants who are in constant relation with the wholesalers of large towns watch for the appearance of new patterns and such as they think the peasant workman can reproduce, they send him, ordering him to reproduce them. Thus, the articles made by these workmen become more and more various.

The many coloured glasses which often decorate rings, earrings and other articles are produced and cut in the same villages; for that purpose white or coloured crystal is used. Such glasses or stones when quite finished are sold at 1.50 to 5 roubles per thousand. Lately, these stones are being principally imported.

Besides the government of Kostroma, articles in silver and in copper silvered

are produced by the peasants in the government of Kazan in the village Rybnoi where rings, bracelets and other ornaments worn principally by the Tartars are made. The peasants work silver also in the governments of Vladimir and Moscow, and in the villages of the latter government the industry is valued at 200,000 roubles.

To the silver industry belong also the black enamel works. This business has been principally practised since ancient times, in Veliki-Oustioug, government of Vologda, where it came according to tradition from Novgorod, during the reign of Ivan the Terrible. Its special characteristics consist in the pretty shades and the durability of the black enamel which differs much from that of Moscow. Now the industry has nearly ceased in Veliki-Oustioug, but is very much developed in Moscow and especially in the Caucasus.

The making of leaf gold and leaf silver belong also to this category of industries. They are made in workshops and by peasants who get the silver and gold in thin ribbons, 14 inches long and 2 inches wide. Such a ribbon which weighs about 7 zolotniks is first cut into small square pieces, which under the hammer are gradually divided into many leaves, the number of which amounts finally to as high as 2,000, each leaf being of 12 inches square; they are put into a book of tissue paper, from 60 to 120 leaves in each. The production of leaf silver and of leaf gold is especially developed in the governments of Moscow and Kaluga, to the value of 500,000 roubles yearly. As in Russia gold of the best quality, namely of 94 standard, is used for making leaf gold; the quality of the latter in Russia is much higher than that of other countries.

The same may be said of the Russian gold and silver thread which by its quality also exceeds the foreign make. The first fabric for such thread was founded in Moscow, about 1770 and its manufacture by hand dates from the introduction of christianity into Russia. Much of this thread is exported to Persia and India. The high qualities of the Russian gold and silver thread and tissues are well known; the Russian gold tissue cloth called *parcha* has no rival of its sort in the world.

The most extensive fabric for making thread and tissues in gold and silver are in Moscow, one of which, belonging to the firm Vladimir Alexeev, has a yearly turnover of 1,000,000 roubles. All the work is done by machines, even the stamping of the so-called sparkles. The household thread making industry is centred in the governments of Moscow and Tver and amounts to the sum of 600,000 roubles per annum. The production of gold and silver in leaves, threads and tissues, including the domestic industry as well, amounts to 3,000,000 roubles yearly.

In conclusion it should be observed that the making of articles from platinum has been introduced into Russia only in recent years and that not in large dimensions, as the demand for objects in that metal is very limited. The principal fabrics for producing articles in platina are those of Kolbe and Lindfors and the chemical works of Tentelev, both of which are in St. Petersburg. They produce apparatus for the condensation of phosphoric acid, evaporating cups, melting pots, plates and wires, and of the latter there is a considerable export.

The production of articles in gold and silver, as also of jewelry especially increased in the years of 1880, and since then it has remained nearly constant. In 1889 there were 52 factories containing 15 steam machines with a total of 250 horse

power, and 2,500 men were employed therein with a total production to the value of 2,800,000 roubles. But taking into consideration that the working of gold and especially of silver is practised in the capitals by separate workmen or by groups of artisans, and that the household industries show also considerable proportions, the total yearly production of jewelry and precious stones amounts to not less than 7,000,000 roubles.

The import of such articles is not great nor necessary, but is due chiefly to the desire of fashionable people to have articles of a certain style, and of foreign make. However, lately great quantities of light and therefore cheap articles in gold are being imported, principally from Germany. The export compared to the import is in every case rather considerable; the principal objects exported are those in silver, as also galloons.

The following table shows the amount of the export and import from 1886 to 1892 of precious metals and jewelry, valued in roubles.

YEARS.	GOLD AND JEWELRY.		SILVER PRODUCTS.		LEAF GOLD, GOLD THREADS AND GAL- LOONS.	
	In thousands of roubles.					
	Import.	Export.	Import.	Export.	Import.	Export.
1886.	190	78	279	111	155	109
1887.	127	124	248	126	77	70
1888.	285	52	376	208	142	22
1889.	225	50	508	216	145	124
1890.	234	51	500	219	193	118
1891.	418	39	389	206	195	164
1892.	211	38	435	159	113	85

PRODUCTS IN COPPER AND COPPER ALLOYS.

To this category belongs a quantity of different products, such as house utensils, church wares, armory, and finally articles of luxury and of art.

Although copper foundries were established in Russia rather late, namely in the middle of the seventeenth century, which delayed the development of the copper industry, nevertheless some articles in copper were produced from ancient times and acquired a firm foundation. The principal of these were bells, which already in the tenth century were one of the most considerable Russian industries of that time. In the seventeenth century the industry was well established as to its technic, as proved by the production in 1653 in Moscow of the celebrated bell, called the Tsar-Kolokol. It is the largest bell in the whole world, is 18 feet in diameter and 19 feet high; about 11,000 pounds of copper were used in its manufacture. Owing to

the fact that bell making is of very ancient origin and to the great demand for bells, the technical side of the industry has attained great development in Russia, and has reached a state of perfection unequalled by foreign manufacture, especially in the making of large bells, ranging in weight from 500 to 1,000 and more pounds each. The principal foundries are in the governments of Moscow, Novgorod, Penza and Poltava.

Peasants make only small bells and the so-called *bubentchik*, which are principally worn on the Russian harness and are universally used in summer and winter by the peasants on all sorts of vehicles. The principal production of such bells is in Valdai, government of Novgorod, where also large bell foundries are located. All the bells for the Great Isaac Cathedral in St. Petersburg were cast in the foundries of Valdai. There are bell foundries also in the village of Sosnovo, Semenovskoe and Lyskovo, government of Nizhni-Novgorod, and in Popovskaia, government of Riazan. The best bells known for the mellowness of their tones are made in Valdai. In general, bell making is very little developed amongst peasants as a household industry.

Table, clock and electric bells, although produced in some establishments of St. Petersburg, Moscow and Valdai, are generally imported.

The dimensions of the bell industry in Russia have undergone no changes during the last twenty years. In the 29 fabrics established in European Russia, Siberia and the Vistula regions, the total of the production in 1890 amounted to 923,000 roubles; there were 286 workmen occupied in the foundries. Including the household branch of the industry the total sum of its production amounts to 950,000 roubles.

The making of bells from steel, which is highly developed now in western Europe, is not yet introduced into Russia, although trials have been made to produce steel bells for railroad signals. There is no doubt that this branch of the bell industry will also take root in Russia very soon, at any rate for bells of small dimensions, as steel foundries have attained great development in the Empire. However, steel bells will scarcely replace bronze church bells; but at all events steel is a great rival of bronze in bell fabrication.

The production of household utensils of copper has existed in Russia since ancient times and was probably introduced simultaneously with the silver industry, as the methods of manufacturing both of these metals are quite the same. Amongst the different household utensils made of copper and latten, the first place is occupied by the *samovar* (tea urn), principally made in Tula and its neighbouring villages lying within a circle of about forty versts from the town.

The samovar industry began in Tula at the end of the first half of the past century, has been gradually developing since then and is now very considerably extended. Although in Tula itself there are several large fabrics, the bulk of samovars are made in villages by the kustars, and in small workshops. A distinctly organized distribution of labour in the manufacturing of samovars exists among the kustars; they generally do not work on their own account, but receive orders from manufacturers or from more or less reponsible workshops, where they also receive the requisite raw material. In the manufacture of samovars only the lower part the so-called *poddon*, or stand, as well as the faucet and handles are moulded, all the remaining parts, namely, the body of the samovar, the neck that joins it to the stand.

the interior pipe and the *conforka* are welded out of sheet latten, and the requisite form is given to them by means of hammers. The lids are mostly made at manufactories where they are stamped under presses. Only in recent years, namely in the beginning of the eighties, one of the local workmen invented a new method of manufacturing the lid direct from the sheet by means of pressing it into a form attached to the rotating spindle of a lathe, and by using a special instrument called *davilnik*; due to this new method it became possible for the *kustar* to manufacture all the parts of the samovar.

The total number of workmen engaged in the samovar industry in the above-mentioned region amounts to several thousands, and the value of the production, because of the costliness of copper, attains to not less than 3,000,000 roubles. The Sergievsk volost alone, near Tula, makes about 40,000 samovar bodies for the Tula manufacturers. Finished samovars are packed by the dozen, which according to a universal custom are of different sizes as follows: two samovars of 13 vershoks, (top measurement) two of 16, two of 17, three of 14 and three of 15 vershoks.

The samovar industry, as a domestic trade, exists also in the government of Perm, in the district of the Syksunsk works which belong to the Crown. Here the quantity of samovars produced yearly amounts to the sum of 85,000 roubles, besides other copper utensils, the value of which ranges from 20,000 to 25,000 roubles. This household industry was organized here by the workmen from Tula, who at the end of the past century came to work at the copper workshop established near the copper foundry in the government of Perm. Later on as the copper veins were exhausted this foundry was converted into iron works. Samovars are also made in one of the largest fabrics in the town of Kirzhach, government of Vladimir, although its principal production is of small brass mortars. In some parts of the governments of Kostroma and Yaroslav samovars are also made, although in small quantities.

The manufacture of copper utensils exists besides fabrics and domestic establishments in all the towns in small workshops. Several years ago the making of copper pans was moreover introduced in the metallic works belonging to a Joint Stock Company in St. Petersburg. Basins, trays and other similar articles in copper are produced in many foundries of which the largest are in the government of Vladimir. These last articles are also made in large numbers, by peasants especially in the Moscow government, where the domestic industry alone is valued at 750,000 roubles. The total yearly production of copper utensils in Russia is valued at about 7,000,000 roubles.

Products in bronze, latten and other copper-zinc alloys, which belong to articles of art, are fabricated in Russia in very small quantities. However, this industry is gradually developing, especially in large towns, where it is centralized in small establishments and shops which very often work for large houses.

Owing to the former Russian customhouse tariff the import of artistic bronze was made very easy and that delayed much the organization of bronze works in Russia. Moreover, the rich classes of society during their frequent visits abroad purchased all sorts of bronze articles and ornaments, as many as they needed, in foreign countries, principally in France, which during the last and the beginning of the present century was the only supplier of bronze for the whole of Europe.

The late Duke Maximilian Leuchtenberg established the artistic bronze industry

in Russia upon a firm foundation. He built a large bronze fabric in St. Petersburg, supplied it with good workmen and rich technical means, owing to which the industry was placed from the very beginning on a strong footing. The Duke himself was the principal workman at his fabric, consecrating his whole free time to the industry. Besides artistic bronze this factory produced galvano plastic articles and had a special section for the production of different objects in plated silver. Many pieces of this bronze, executed by this factory, which after the death of the Duke Leuchtenberg passed into the hands of Henke, Pleske and Moran, decorate the Cathedrals of St. Isaac in St. Petersburg and of The Saviour in Moscow, and many palaces and houses of rich people. This factory went out of existence many years ago although one of the Duke Leuchtenberg's successors, Moran, has until now a small bronze foundry.

The Guerin bronze factory exerted a great influence on the development of the industry in Russia, especially when in 1840 it passed into the hands of Chopin; it was founded in the beginning of the present century. Owing to the talent of a Russian sculptor Lanseré, the foundry of Chopin executed a whole series, about 130 numbers, of excellent groups which are celebrated over all Europe and America. After the death of Chopin, which happened in Paris in 1892, his heirs sold all of the Lanseré models to Stange, a manufacturer in St. Petersburg. This last fabric is also well known for its bronze productions of high quality, which are principally articles of furniture, such as lamps, lustres and others. A similar fabric was also founded in 1868 in Moscow, by Postnikov, but principally for the fabrication of church articles. It had a great influence on the development of artistic finish of the works of the bronze industry, by introducing beautiful designs in enamel.

The manufacture of lamps and their appendages is especially developed in Warsaw where the trade, according to official data, is valued at 500,000 roubles.

The factory of the Duke of Leuchtenberg and of his successors, as also that of Chopin, were the real originators of the artistic bronze industry in Russia, and produced whole generations of bronze workmen, who have transferred their knowledge, skill and experience to many small works, and some of whom have opened their own small workshops.

During late years a considerable number of such factories for producing small articles from leaf bronze, or rather latten, have been started. These articles, of very satisfactory quality and design, are very cheap and are, therefore, bought in large quantities, even by the poorer classes. The schools of practical drawing have doubtless had a great influence on the development of the industry; the import of such goods has in consequence rapidly decreased of late years. It is to be hoped that soon the production of small stamped latten decorations, used for albums and the like, will be introduced into Russia.

St. Petersburg and Moscow are the principal points for the bronze industry, which is very little practised by the peasants. It is very probable, however, that with the increased demands for cheap bronze articles the trade will begin to develop in the villages, especially in those where small pieces in brass are already produced, and which are made in large quantities in the village Lyskovo, government of Nizhni-Novgorod. Shirt studs, buttons, thimbles and other like articles, are yearly produced here to the value of 100,000 roubles, owing to the proximity of the

Nizhni-Novgorod fair, where they are principally bought by the Persians, Bokharians and Armenians. The production of such goods as artistic bronze, lustres, candelabras, lamps, candlesticks, objects for cabinet tables, and the like, amounts yearly to about 2,000,000 roubles.

One of the most extensive uses of copper alloys, is the manufacture of shells for metallic cartridges. This industry is principally centralized in Crown fabrics, although there are two private factories, of which one, in Tula, works for the Ministry of War. The metallic shells for cartridges are made by machinery and the technical part of the industry is on a very high grade of development. At the beginning, the leaf brass required for the fabrication of such shells was principally imported from the United States. This brass was of very high quality, owing principally to the purity of the copper produced from the mines of the Lake Superior region and also to the relative purity of the zinc. But later on, the cartridge works began to use Russian brass which was produced by three foundries, two of which were in St. Petersburg, one belonging to a Franco-Russian Company and the other to Chikin, and the third, in the government of Vladimir, belonging to Kolchongin. Outside of the above mentioned foundries, cartridge shells are produced in very small quantities in the Empire.

Since the manufacture of cartridge shells was introduced in the Crown foundry at St. Petersburg a new section had to be organized there, namely an instrument branch. This section was designed to prepare instruments for most precise measurements, as also implements, such as stamps and matrix moulds for making tubes and cartridge shells. To what a degree of exactitude this industry has attained may be seen in considering the delicate requirements of cartridge making. It is no longer difficult to limit the dimensions of the different parts of the cartridge to 0.001 of an inch, and of instruments to 0.0001 of an inch. The contingent of learned smiths has facilitated the progress of this work, and many other manufactures, especially the making of mathematical, physical and telegraphic instruments which, as is known, require very great exactitude.

Brass tubes, cloth-printing cylinders, locomotive furnaces and other heavy articles of machinery are manufactured by many firms, the chief of which is the Brass-rolling Mill and Tube-making Manufactory, in St. Petersburg, formerly owned by Rosenkranz. The general production of this manufactory, the rolling of sheets included, amounts to about two million roubles a year. The manufacture of brass and latten tubes for steam boilers, and of surface refrigerators at the Izhora works at Kolpino, belonging to the Admiralty, forms a prominent branch of the industry, rated at the average value of 100,000 roubles per annum.

Brass fixtures, brought a short time since wholly from abroad, chiefly from Germany, are manufactured at some works specially organized for the purpose, thus furnishing the means to make very cheap articles, and very satisfactory in quality. Many factories have already introduced the moulding of such goods from metallic models by machinery, and have in general established the business on a sound footing as regards technical qualities. The fixtures made at these manufactories, such as stopcocks, valves, oil boxes, steam whistles and the like, are of many types of construction, and show many varieties of each type. This manufacture is chiefly concentrated in St. Petersburg and Moscow, and together with the making of tubes and

other parts of machinery may be estimated at not less than two million roubles per annum.

It has been noticed of late that, like mechanical fixtures, the manufacture of articles required for gas and electric lighting, until recently brought from abroad, has developed greatly. Moreover, with the large manufacture of brass, bronze and latten articles the smaller industries also should be mentioned, for instance, the making of buttons, the yearly output of which amounts to 200,000 roubles, as well as that of harness, carriages, stove fixtures, brass foil and the like. A great part of these manufactures, however, are hand-made, so that it is not possible to have exact information as to their amount and value.

Finally, the articles of white metal and of copper plated with silver should be considered. The latter on account of the great competition of melchior, that is, white metal articles, or German silver, are going more and more out of use, plated silver being preferred except for church use.

The manufacture of melchior in Russia dates from long ago; the principal factories producing such articles, to the value of more than one million roubles, are concentrated in Warsaw, where this branch of trade was first established. Mechanical contrivances are used for this work, stamps and rollers being of first importance. If St. Petersburg, Moscow and some other places be counted, the production of melchior and articles of plated silver may then be estimated at not less than one and a half million roubles yearly. Thus, the general output of bronze and brass articles, the hand-making and trade establishments included, according to the existing data, amounts to about 16 million roubles yearly.

The following table shows the import and export of brass and bronze articles from 1886 to 1892.

Y E A R S.	Wares of brass and brass alloys.					
	SIMPLE WARES.		WARES WITH ORNA- MENTS IN RELIEF.		GOLD AND SILVER PLATE.	
	T h o u s a n d s o f r o u b l e s .					
	Import.	Export.	Import.	Export.	Import.	Export.
1886.	2,177	143	78	55	69	Is included in the preced- ing column of export.
1887.	1,215	168	60	57	63	
1888.	1,053	262	42	53	62	
1889.	1,517	191	67	137	73	
1890.	1,432	143	67	32	67	
1891.	1,314	320	152	48	63	
1892.	1,313	211	472	69	89	

ARTICLES OF ZINC, TIN, LEAD AND THEIR ALLOYS.

The wares of this category are far from having the same importance in the industry of metals as those of brass; a secondary place is allotted to them, however, not only in Russia but abroad. Moreover, it should be mentioned that as tin and lead are worked in insignificant quantities in Russia, foreign materials are exclusively used for the manufacture of such goods. Zinc too, although its casting was long ago begun in the Vistula governments, rich in zinc ores, is imported in rather considerable quantities, which in 1889 began to exceed even the amount of internal product; the latter fluctuated between 220,000 and 280,000 pounds for the last decade and was unable to satisfy the home demand.

The need of zinc, as an integral part of latten and green copper, has evidently increased of late years, as the import of copper in bars has also constantly increased, notwithstanding the growth of copper wares in Russia and the high duty paid thereon. Moreover, the rapidly increasing manufacture of cast zinc articles should be considered. Due to the universal use of kerosene lighting of late years, even in the villages, a large demand for lamps followed, the standards and fixtures of which are mostly cast from zinc.

Furthermore, zinc is now often substituted for green copper in the manufacture of different small household articles. The fashion for zinc figures and various ornaments now in vogue called forth the organization of several establishments in St. Petersburg, Moscow and Riga for the making of such articles.

The use of sheet zinc also increases constantly; it is more and more employed in house building, for example, for cornices, eave troughs, gutters, columns for the balconies, and the like. Lately a new branch of the industry was introduced into Russia, namely, the plating of zinc sheets with nickel; such sheets are used for sponging woollen stuffs, and were formerly always imported. The value of the zinc manufactures amounts approximately to 2,500,000 roubles.

As to the articles made of lead, they are not very diverse; tubes, lead pipe, shot and bullets are the principal; bottle capsules and lead foil come next. Lead in alloy with antimony is used for type; in alloy with tin, for kitchen ware. The annual import of lead for the last few years exceeded 1,000,000 pounds, and in 1892 it was 1,600,000 pounds, the internal lead works in Siberia, in the Caucasus and on the Kirghiz steppes amounting only to 50,000 pounds. Thus, Russia yearly consumes lead to the amount of nearly 4 million roubles, reckoning the metal at 2.50 roubles per pound.

Type is the most costly article produced from lead; its average price is 20 roubles per pound; the price of the other articles, as lead pipe, shot, bullets, bottle capsules and lead foil, does not exceed, on the average, even double the price of the raw metal. Thus, the yearly value of lead manufactures can be fixed at about 6 million roubles.

Tin is rarely used alone. A sufficiently large quantity of it goes to the manufacture of tin plate; moreover it is used as an integral part of bronze, and for tinning, soldering and the like; therefore, the value of tin must be considered as entering into the price of different bronze goods. Articles of britannia, that is, an alloy of tin and antimony, are not made in Russia, and their use is very limited. They

are yearly imported to the sum of 25,000 roubles. Thus, the value of the output of this group of metals can be placed at about 8,500,000 roubles per annum.

The import of zinc and tin goods, the latter forming a very small amount, as well as of lead wares, and various articles used for printing, such as type, matrix moulds, cliché and the like, is in general not large, and its fluctuations are few, as may be seen from the following table.

YEARS.	ZINC WARES.	LEAD WARES.	TYPE.
	Thousands of roubles.		
1886.	352	20	99
1887.	192	30	100
1888.	181	21	123
1889.	229	19	125
1890.	246	32	159
1891.	255	50	114
1892.	182	23	143

BLACKSMITH WARES AND ARTICLES OF SHEET IRON.

The forge belongs to one of the most ancient trades: its establishment corresponds in general to the discovery of iron ores in various localities, while foundries and forging were often done in the same shops. The superfluous iron was sold, and therefore smithies were organized in those places where no ores were to be found, principally on navigable rivers and large trade centres. The number of smithies increased with the development of the iron manufacture; some of them began even to work certain articles as a speciality. Thus, the Ulomsk region, district of Cheriepovets, government of Novgorod, developed the nail trade of various kinds, from boot nails to ship nails, the work being exclusively hand-made. The nails of Ulomsk formerly sold very readily on all markets; other nails were not able to compete with them.

In the above mentioned region at the beginning of the seventies about 600,000 pouds of nails were forged, to the value of nearly 3 million roubles; but later on, with the appearance of machine-made wire tacks and cut nails, the trade rapidly decreased, and at the present time it has lost its former importance, and only large nails, especially ship nails, are now forged.

The manufacture of nails is general also in some of the districts of the governments of Tver, Nizhni-Novgorod, Viatka and Yaroslav. In the government of Tver small nails and tacks are still produced in great quantities, and their output amounts to 400,000 roubles a year, the nails varying in price from 3 to 8 roubles per pound: in the government of Nizhni-Novgorod the nail industry reaches 300,000 roubles, and in the Viatka government, 150,000 roubles.

In the governments of Nizhni-Novgorod and Viatka, chains and anchors are forged to a considerable extent; in the latter government, carriage fixtures are forged.

In the government of Perm, in the region of the Nizhni-Taghilsk manufactory, the making of scoops, shovels, basins, pails, spades, hoes, stoves and the like, is very general, the value amounting to 200,000 roubles per year.

Regardless of the above mentioned specialities, the forge and smithy are the most widely spread of the crafts in the Empire, as is easily understood on considering the absolute necessity for the manufacture and repair of the small implements of husbandry, especially for the making of horseshoes and diverse cars, and repairs of vehicles, and the shaping of household articles. In order to have an idea of the extent of the smithy among hand workers, the Viatka government may be taken as an example, where the wares of the forge not only supply the needs of the local inhabitants, but are sold to a considerable extent beyond the limits of the government. From carefully collected data the production of the hand forge of the Viatka government alone amounts to 1,250,000 yearly. Although in most of the other governments the smith craft is not of so much importance, still it everywhere holds a conspicuous place in the category of other manufactures. The making of horseshoes by hand, for example, is especially developed near the town Kassimov, in the Riazan government; the price of a set of four shoes generally varies from 30 to 50 kopecks.

Hand forging is still practised very generally in the manufacture of most of the above mentioned wares; nails, however, as has been already said, are principally made by machinery, from wire or sheet iron cut into strips, and from bar or plate iron. The production of nails in that case is by the cold process, thereby evidently economizing the iron, as considerable is always lost in burning, and further lessening the cost of manufacture by the more rapid process of making nails from cold iron. Some sorts of horseshoe nails, however, are subjected to the heating process. Moreover, the number of machine-made nails per pound is always greater than when forged by hand.

The factories for making nails by machinery, according to the latest improvements in the industry, are chiefly centred in the large cities, principally in St. Petersburg and Riga, often in conjunction with wire manufactories. At present Finland remains as the chief producer of hand-made nails, its yearly production amounting to 200,000 pounds, the greater part of which are used for ship building.

As for horseshoe nails, the most of them are machine made; it should be stated that the heating process is practised at the great manufactory at Vileika and the cold process at the manufactories of St. Petersburg.

The building of railways and their reparation called forth a new branch of industry, namely, the manufacture of the tie-nails and clamps, and which are made at special factories as well as at the rail-rolling mills. The work is exclusively machine made, and foot hammers of the Oliver system are preferred for forging clamp nails.

The Crown manufactories, Kolpinsk near St. Petersburg, and Votkinsk in the Ural, are justly renowned for the forging of strong chains. The quality of the metal used in this manufacture, as well as the tests of the finished chains are fixed by special regulations, and their solidity and uniform strength are warranted. For the curving and soldering of the links, mechanical processes are used. The Kolpinsk Manufactory, working almost exclusively for the Admiralty, has produced in recent years about 25,000 pounds of chains per annum, the thickness of the links being from a quarter of an inch to two inches and three-quarters, and the average price, about ten roubles per pound.

The hand-making of chains is, as mentioned above, widely spread in the government of Nizhni-Novgorod, namely, in the church village of Besvodnoe and the adjoining villages, as well as in some parts of the Semenovsk and Balakhninsk districts of the same government. The output here of this manufacture is placed at 100,000 roubles; the industry constantly improves, although with no such rapidity as could be expected in view of the great demand for chains for ships, and for sea and river boats.

The absence of regular chain tests for want of proper machines for that purpose compels many of the ship owners to buy chains at higher prices from the Crown manufactories, and even of foreign make.

At the village Besvodnoie, chains are exclusively hand made; for the finest rod iron of a quarter of an inch in diameter is used; the thickest are made of the same iron, but of a diameter of one and three-quarter inches. The price varies according to the diameter, from 3 to 5 roubles per pound, their length averaging from 15 to 20, very rarely 30 sagenes.

Large anchors are manufactured exclusively at the Crown works, Kolpinsk and Votkinsk, where special machinery for the work is in use, especially heavy steam hammers; each anchor is thoroughly tested as prescribed by law before it is permitted to leave the works. The official data show that the Kolpinsk manufactory produces, for the requirements of the navy, anchors of Martin and Trotman patterns, the heaviest of which is 450 pounds: the price for such anchors varies from 14 to 29 roubles per pound. The prices at the Votkinsk works are considerably lower. Of the private manufactories the Dobriansk, owned by Count Stroganov, makes good anchors of small dimensions for local navigation. Hand-made anchors are chiefly confined to Gorodets and the village Bor, both in the vicinity of Nizhni-Novgorod, but the quality of these anchors is far from being satisfactory, as a poor kind of iron and all sorts of scraps are used in their manufacture. They are made of a weight of 6 to 47 pounds, and their price varies from 2.20 to 3.80 roubles per pound.

The manufacture of spades, hoes and kindred implements is spread in different localities; the best equipped works are, no doubt, the Crown arsenals, where various mechanical contrivances have been introduced, especially for the working of spades. Lately a very well equipped factory has been founded at St. Petersburg by Spiegel, which produces chiefly spades and some other farm implements. Furthermore, the house-building articles, such as stairs, window frames, rafters and the like, are made at mechanical manufactories together with various machinery, or at trade establishments found even in the smallest towns.

By reason of the extreme variety of the blacksmith wares in general, and especially as the household industries are greatly diversified, it is impossible to give, even approximately, the value of their production. However, it can be stated that the general output of the blacksmiths is something more than 20,000,000 roubles annually. Of wares of sheet iron and steel, plate and packing cases must be given the first place. Plate is generally made of black iron, and then tinned or enamelled, or of white iron, the latter being preferred for light wares. Packing cases boxes, cans and the like are exclusively made of tin.

A very large production of black and tinned plate has long since been established at Kassimov, government of Riazan, by the merchant Salaskin: due to the

country fairs, especially to the fair of Nizhni-Novgorod, his wares are widely sold, his very low prices being active factors in furthering the trade. For example, at the Fair of 1890 in Nizhni-Novgorod, the black plate was sold at the price of 2.85 to 3.10 roubles, and tinned plate at 4 to 8.25 roubles per pound, according to the sizes of the articles. The same kind of plate is manufactured by smaller dealers at Kasimov, as well as in some other localities of Russia, especially in the government of Perm. The manufacture of forms for sugar loaves, owing to the constant growth of the sugar industry, holds also a very conspicuous place among other trades.

The manufacture of enamelled iron plate was established only in 1881, and has a sole representative in the factory of The Volcano Co. in Warsaw. This factory, using at present mainly soft cast iron, is fitted out with the newest and most powerful machinery, endowing it with the necessary means for stamping plate of very large proportions, and great depth. The quality of the enamel and the great variety in the forms of the articles produced leave nothing to be desired; however, the prices are rather high, due to the absence of competition. In addition to this new kind of ware, the Volcano Factory continues its former work, namely, the making of tin plate. The general production of this factory amounts to 220,000 roubles per annum.

Of the wares made of sheet iron a conspicuous place is held by trays, bread baskets and like articles, which are almost exclusively hand made, chiefly in the Moscow government, and thence sent over all Russia. These wares are generally sold in a painted and varnished state; the trays are frequently decorated with various designs, chiefly flowers, which are not badly executed for village painters, mostly after their own fancy. The iron wash stands, made in the same localities of the Moscow government, are also related to this kind of trade; owing to their cheapness they compete successfully with the town wares, in the making of which sheet zinc is mainly used. The manufacture of painted wares of sheet iron amounts in the Moscow government alone to 150,000 roubles, and for all Russia, its value must be reckoned at not less than 750,000 roubles yearly.

The production of welded pipes can be regarded as an important branch of industry, seeing that in 1876 a manufactory was founded in St. Petersburg by Shodouar, a Belgian subject; attempts of the kind had been made in the sixties at the Vyksounsk factories of the Shepelev. Recently, in 1890, a second pipe-rolling manufactory was founded by this firm in the Ekaterinoslav government; in 1884 such a factory was established in the small town Sosnovitsi on the western frontier. The production of these three works amounts to over 300,000 pounds yearly, to the value of 1,500,000 roubles. The import of iron pipes, however, notwithstanding the development of the home industry greatly increases, so that in 1887 it amounted to 31,000 pounds, in 1888, to 97,000 pounds, and in 1889, to 101,000 pounds; this increase is easily explained by the great development of the construction of aquaducts in the towns of Russia.

The different kinds of tin cans used for packing, as well as all sorts of tin plate, are almost exclusively home made; they are manufactured in many towns, but especially at Moscow and St. Petersburg, where besides handwork, machinery is used. Tin cans are also manufactured on a large scale in the localities engaged in the preparation of preserves, the latter industry increasing greatly of late. The cele-

brated manufactory at Batoum should be mentioned, which uses one million pouds of foreign tin, imported duty free, for the manufacture of tin cases for the export of kerosene.

Finally, the production of iron barrels for the export of alcohol, and the manufacture of pipes, stoves and other house-heating appliances should be added to the list of products of this section. The goods of the first category are generally made at manufactories; those of the second, in trade establishments, at which hand machines are also frequently used, especially for the manufacture of elbow pipe. Owing to the great variety of the articles produced of sheet iron and tin and the scattered state of the factories, the exact value of the industry cannot easily be given; it may be estimated, however, in round numbers at eight million roubles, excluding the production of the Batoum works.

Lastly, another industry, where the forging process is used, should be mentioned, namely, the manufacture of iron fences and gates, which are often of a very elegant form and decorated with cast iron designs, representing branches, leaves and flowers. The chandeliers and wall brackets, growing more and more into use in rich houses for halls and staircases, come under this category. Many of these articles as to design and finish can be rightly placed among the works of the fine arts. Manufactories producing this kind of wares were established in St. Petersburg, Moscow and Odessa, some 15 to 20 years ago, and notwithstanding this short period of time, have attained a great degree of perfection chiefly due to the schools of practical drawing.

The import of the wares of the blacksmith, including steel, according to the data given by the customhouses, and of wares of sheet iron, black as well as tinned and enamelled, and the exports thereof, are shown in the following table for the years 1886 to 1892.

The amount of the export of these wares is included according to customhouse data in the general total of iron goods. In 1891 and 1892 according to the same statistics the import of steam boilers and iron pipes, which has been rather marked, is included.

YEARS.	Blacksmith wares and wares of black iron.	Wares of tin and sheet iron.				
		SIMPLE AND ENAMELLED.		WITH GOLD PLATE AND ORNAMENTS.		
		In thousands of roubles.				
		Import.	Import.	Export.	Import.	Export.
1886.	1,769	424	3	44	Included in the preced- ing column of export.	
1887.	1,592	337	4	34		
1888.	979	243	4	36		
1889.	1,274	350	12	49		
1890.	1,127	411	6	59		
1891.	1,291	487	12	74		
1892.	961	492	6	58		

MANUFACTURES OF CAST IRON AND STEEL.

The making of cast iron in Russia dates from the first half of the seventeenth century. In 1637 a Dutchman, named Vinius, established with the sanction of the Tsar Michail Feodorovich the first cast iron foundry, near the village Torokhovo, fifteen versts from Tula. The founding of steel was introduced in Russia only recently.

Two methods of making cast iron are to be distinguished; the first founding, in high furnaces; and the second founding, in cupolas and hot blast furnaces. Most of the cast iron wares in trade are made in the high furnaces, and this method of manufacture has a direct influence upon the cheapness of such goods. In such manner cast iron plate, artel kettles, diverse stove appliances, pipes and other articles are made, requiring no special compactness of the metal nor marked resistance to mechanical force. On the other hand, castings pertaining to different parts of machinery, because of the higher quality of the material and of the precision required, are always cast by the second process, that is, in the hot blast and reverberatory furnaces.

The village workers, *kustars*, generally produce very little cast iron, and that chiefly for implements of husbandry and machines of rural economy; thus, the representatives of this kind of industry are mainly the mining works and mechanical manufactories, as well as special cast iron foundries. The fuel used in founding cast iron in hot blast furnaces is generally wood coal in the Urals, anthracite in the South, and coke in all other localities; some of the Ural manufactories, however, find it profitable to use coke, and even the dearer Donets coal, when founding cast iron in the hot blast furnaces.

The pipes required for aquaducts and gas mains were formerly brought exclusively from abroad, chiefly from England; but since the tariff of 1867 was introduced, the casting of mains began to be established at the Russian works. Now there are already several manufactories scattered in various places of Russia furnishing wares of very satisfactory quality; many of them have lately introduced the machine moulding process. Cast iron enamelled plate is equally made now in varying quantities at the Russian high-furnace manufactories, chiefly established in central Russia, namely, in the government of Kaluga and in the Vistula region, where the first place is allotted to the Petrokov government. During the years 1880 to 1886 the production of this kind of plate, with but few fluctuations, can be fixed at from 57,000 pounds in 1885, to 88,000 pounds in 1886, and from 1887 it has constantly increased as shown below.

Y E A R S.	Pounds.
1887	158,000
1888	205,000
1889	254,000
1890	289,000

In recent years the price of cast iron enamelled plate at the Fair of Nizhni-Novgorod was 3.20 roubles per pound; at the manufactories of the Vistula region it sold from 2 to 2.40 roubles per pound. Wares of soft cast iron are also worked at some of the manufactories; however, this trade is not conducted on a large scale.

The casting of articles of the fine arts, the chief representatives of which are, from long ago, the Kyshtym manufactories of the Urals, does not represent any considerable branch of industry. It does not even form any part of the regular production of these works, although, due to the special qualities of the cast iron employed, permitting of the finest finish, the wares of the Kyshtym works, being very cheap, could easily find markets abroad, especially if subjects of Russian life were treated in the designs. The articles produced are generally not of large size, and owing to their pure outlines and evident material are never stamped; they bear a great resemblance to works made of bronze.

In order to give an idea of the relative distribution of the different kinds of cast iron articles (the casting of bombs and shells for the artillery being excluded), among the different mining works and various foundries, as well as to show the market growth of the industry, the following table based upon official data of recent years has been prepared.

YEARS.	FOUNDING IN HIGH FURNACE- CES.	FOUNDING IN HOT BLAST AND REVERBERATORY FURNACES.		TOTAL.
		Mining works.	Foundries for cast iron.	
	In thousands of pounds.			
1886.	2,956	3,316	1,908	8,180
1887.	3,401	3,178	1,600	8,179
1888.	3,966	3,497	2,110	9,573
1889.	4,004	5,378	1,670	11,052
1890.	3,906	4,444	906	9,256

It should be mentioned that the quantity of the casting in hot blast furnaces, given in the column of foundries for cast iron, does not show the full amount of the yearly production of these foundries, because the castings made for private customers at the mechanical manufactories and those included in the statistics on machinery building, have not been considered here. The general total of this kind of castings should be reckoned at not less than half of that given in the table above.

Thus, making due allowances for the total, and counting the average price of simple cast iron by high furnace as well as by cupolas, at 1.50 roubles per pound, the value of the production as well as the quantity produced and the import and export thereof for the years from 1886 to 1890, may be given as in the following table, which equally shows the import and export for the two succeeding years, the data for the home production having not yet been published. The crude castings are not separated from the elaborated works in the amount of the export column.

YEARS.	HOME PRODUCTION.		IMPORT.	EXPORT.
	Thousands of roubles.	Thousands of pouds.	Thousands of pouds.	Thousands of pouds.
1886.	13,701	9,134	248	5
1887.	13,469	8,979	179	16
1888.	15,942	10,628	160	4
1889.	17,831	11,887	124	15
1890.	14,564	9,709	138	18
1891.	—	—	58	23
1892.	—	—	65	18

As to steel casting in the strict sense of the word, the industry increases yearly and is particularly developed in some of the foundries, and attains a very high grade of products; amid the latter, the castings of stems, stern posts, and screw propellers for men of war, should be mentioned. The rolling of steel iron plates of considerable thickness at the Izhora Crown Manufactories in Kolpino, testifies to the great mechanical force of the factory, as well as to the high degree of technical development. Cast steel is worked at the St. Petersburg manufactories and also at the Ural and south Russia factories.

Besides the steel articles made by simple casting, the Russian manufactories are engaged in the production of various goods of cast steel blocks by forging, stamping and rolling. Thus, car and engine wheels for railways, axles, bands, springs, car beds and other articles of furniture for the rolling stock and road beds of railways, are now supplied exclusively by Russian works. The price of these articles, owing to the increasing cheapness of cast iron and to the development of the trade in itself, shows a visible tendency to decline. This refers equally to various parts of machinery, for example, the simple and crank shafts, connecting rods, couplings and kindred appliances. The manufacture of the railway bands alone, which in 1889 amounted to 640,000 pouds, and in 1890, to 668,000 pouds, proves that the production of the various kinds of steel wares in Russia, especially those relating to rolling stock and road beds, has already reached great proportions, warranting the possibility of supplying the railways with articles of home make.

Owing to the absence of any detailed information concerning the kinds and quantity of the wares made at each of the steel founding works, it is impossible to state the exact quantity and value of the articles cast, forged, stamped and rolled from steel. The following data, received direct from the two manufactories at St. Petersburg, the Oboukhovsk and the Poutilovsk, will give, nevertheless, a general idea of the state of the cast steel industry. It must be said, however, that the speciality of the Oboukhovsk manufactory consists in the making of articles for armament, and that the Poutilovsk works produce principally articles for railway and engineering uses, and to some extent for ship building and the making of armor.

For the years 1886 to 1892 the production of these two manufactories, the orders of various kinds of rails and those of the Department of War being excluded, may be expressed by the following figures.

MANUFACTORIES.

YEARS.	ОБОУХОВСК.	ПОУТИЛОВСК.
	In thousands of roubles.	
1886	198	2,183
1887	27	2,607
1888	132	1,758
1889	77	2,424
1890	227	1,757
1891	18	1,407

The Alexandrovsk Steel Manufactory, also at St. Petersburg, ranks between the two factories above mentioned. Its yearly production of steel wares, excluding rails, together with the production of assorted and sheet steel, amounts to about 2,000,000 roubles. Considering the general information received respecting the activity of Russian steel manufactories, the amount of their output can be placed at not less than 6 to 7 million roubles. Unwrought steel, rails, cannon, ammunition, as well as fire and side arms, are not included in this total.

GUNS, ARTILLERY SUPPLIES, AMMUNITION AND FIREARMS.

The articles of this category representing the means of State defense, exclusive however of hunting guns, are chiefly made at the State manufactories, which occupy such a high position with regard to their technical powers that they can compete with the best works of Europe and America in quality of work.

The long distance guns of considerable length and 12 inch caliber with which the Russian armor-clad ships, constructed in recent years, are provided, also the battery guns and other arms of heavy artillery, as well as steel balls and shells, proof to the strictest trials of firing at armor, testify to the eminent technical virtues of the manufactories and to the unquestionable experience and skill of the managers. The Oboukhovsk Steel Founding and Gun Manufactory, now belonging to the State, always keeps watch over the contemporary technical development of this branch of industry, and promptly introduces all new inventions, the practical results of which have been duly proved. Many processes of a special character are worked out at the manufactory itself; among these the most conspicuous is the process of cooling in mass, introduced already in 1868, which makes it possible to obtain steel of uniform structure, and at the same time, to increase its resisting powers.

At present the technical equipment of the Oboukhovsk Manufactory, as represented by 11 puddling, 27 hot blast and 3 Marten furnaces, and by 240 casting furnaces, 2 converters, 15 steam hammers, the largest being of 50 tons, one hydraulic press yielding 7,000 tons pressure, furnishes it with the means to execute all the orders of the Department of War and Marine, for guns as well as for artillery purposes in general, and to fulfill in the mean time many orders from mechanical works and railways. The yearly production of this manufactory, including that of assorted steel and blocks used for sheet rolling, amounts to 3 million roubles.

According to official data the Oboukhovsk Manufactory produced from 1887 to 1892 the following amounts of the most important goods.

YEARS.	GUNS.	FURNITURE.	GUN CARRIAGES.	MINING.
	I n p o u n d s			
1887.	59,858	—	25,482	—
1888.	61,406	4,166	12,355	1,820
1889.	39,834	3,606	11,215	1,280
1890.	66,126	800	12,241	1,760
1891.	65,607	561	39,792	1,199

The product of this manufactory for the same period including not only the above mentioned wares but also all sorts of orders executed for the Departments of War and Marine may be seen from the following figures.

YEARS.	THOUSANDS OF ROUBLES.
1887.	2,377
1888.	2,508
1889.	1,772
1890.	2,552
1891.	2,342

The gun manufactory at Perm, founded in 1863, belongs also to the list of well equipped factories in technical respects; it owns a 50-ton steam hammer of high pressure, and all the necessary means for the working of guns, artillery supplies and other articles required by the Department of War. Running 21 steam engines, yield-

ing on the whole 2,400 horse powers, 4 Marten and 10 hot blast furnaces with 60 melting pots each for casting steel, together with 8 cupola and 9 reverberatory furnaces for making cast iron, this manufactory employs on the average 2,500 hands. During the years 1886 to 1891 it produced to order steel guns and war supplies as indicated below.

Y E A R S .	GUNS.	SUPPLIES.
	I n p o u n d s .	
1886	25,006	—
1887	27,698	5,523
1888	10,607	8,862
1889	14,076	8,245
1890	7,578	—
1891	5,998	20,997

This manufactory is constantly supplying the State, with cast iron artillery supplies, and until 1888 executed an order for guns of the 11-inch caliber and carriages therefor: moreover, the factory produces steel casting and other goods, among them railway appliances, as well as assorted and sheet steel. The general production of the Perm Manufactory amounted in 1891 to over one million roubles. Steel artillery furniture is made also in private manufactories, chiefly in St. Petersburg at the Poutilovsk, Alexandrovsk and the Franco-Russian Co. The Poutilovsk Manufactory has executed in recent years orders for the Department of War, valued from 500,000 to 700,000 roubles yearly.

As to artillery supplies made of cast iron, they are worked at the Crown foundries as well as at certain private works. The existing data show that from 1886 to 1890 the following quantities of artillery guns of various calibers have been cast at the Crown works by means of cupola and reverberator furnaces.

Y E A R S .	P O U N D S .
1886	560,272
1887	417,170
1888	336,422
1889	287,790
1890	449,161

Moreover a considerable quantity of artillery goods are yearly produced in the government of Perm at the Kamensk Crown Manufactory where the casting is done by the high furnace method. Finally, the guns requisite for the army are made at three manufactories, namely, the Sestrorietsk, in the government of St. Petersburg, the Tulsk, at Tula, and the Izhevsk, in the government of Viatka. These works are provided in all their sections with the best machines of the newest construction, so that the different parts of the lock are made so accurately as to outlines and dimensions that they can be easily replaced if need be.

The armory in Russia dates from long ago; in the sixteenth century the gunsmiths of Tula were already renowned; they made side arms and guns of the iron provided by the peasants of the locality, who worked it in their *doushnitsi* (a kind of oven) directly from the ores. This kind of gun manufacture existed probably at the same time at Veliky-Oustyug. In 1595, by order of the tsar Feodor Ioannovich, thirty smiths of Tula were settled in a small village which may be regarded as the foundation of the gun industry in Tula, as well as of the corporation of the armorers obliged to work for the Crown and enjoying therefore special franchises and privileges. It would be well to mention that in the second half of the seventeenth century one of these smiths distinguished himself by his capacities, namely, Nikita Demidov Antoufev, or Antonfeev, the progenitor of the renowned family of the Demidovs, and was chosen by the genius of Peter the Great for the organization of the first high furnace and iron works in Tula. These works were required to supply the army with balls, and the gunsmiths of Tula with the necessary iron. Later on, Demidov transferred his business to the Urals where, due to his energy and knowledge, he rendered great service to the iron works industry.

At first the armorers made guns at home, and only in the years 1705 and 1706 the first armory yard was organized, with sixty furnaces for the welding of the barrels. The boring and finishing of them was still done by the smiths at their homes. These last operations were introduced only in the new stone armory yard built in the year 1718, and supplied with a water propeller; but after a short time this yard was closed at the request of the armorers, who were allowed to execute all the works at their home as before. Although the manufactory or armory yard was reopened afterwards, yet the greater part of the Crown smiths continued, notwithstanding, to work in their own home shops. This course lasted even after the emancipation of the armorers, in the year 1864, from the obligatory relations to the manufactory. Only in the year 1873, when the works were entirely reorganized and supplied with new machinery, the execution of Crown orders at the manufactory was stopped.

At the beginning of this century an essential reform was introduced in the works of the Tula manufactory, namely the stamping of the hammer and of the different pieces of the lock instead of forging them, the latter method proving to be too slow and difficult because of the small dimensions and exactitude of the articles prepared. This reform was introduced about 1817 by a special gunsmith brought from England and resulted not only in the improvement in the quality of the gun and the reduction of prices of labour, but also in the teaching of the smiths a new method of shaping and working iron, the latter directly influencing the development of other branches of metallurgical industry, for example, the manufacture of locks and fixtures.

The gun works in Tula were reorganized in the year 1873 and shortly after received the title of Imperial Manufactory. It is moved by three Jonval turbines of 120 horse power each, and in addition it has two steam engines of 150 and 50 horse power in order to prevent the stoppage of the works in case of high floods. The total quantity of complete machines, ordered mostly from England, amounts to about 900 pieces. This manufactory is justly considered one of the most important and well organized of the European manufactories; all the parts of the gun are manufactured by machinery and the exactitude and finish as well as the adjustments of the several parts are not inferior to those of the best foreign makes. The production of the Tula factory is enormous; at the time of its greatest activity from 1877 to 1881, that is, during five years, these works turned out 685,425 guns, or on the average more than 137,000 guns annually. From 1873 to 1874 the barrels and cases, made exclusively of steel, were furnished to the Tula Manufactory by the Izhevsk steel works, while up to that date these parts were imported from Austria.

The army having received a new equipment the orders were reduced for a time. Therefore, the Tula manufactory as well as others were allowed to make hunting guns and side arms for private customers, as by such privileges the best workmen could be retained. In late years the Tula works alone made such guns to the value of fifty thousand pieces yearly. From 1885 the said factory has also been working revolvers of the military pattern, which had been until then imported. The yearly production of such revolvers amounts to about eight thousand pieces. Finally, in the year 1886 these works began the making of the Hotchkiss cannons for the Admiralty. Now that the arming of the militia will be changed for the guns of the three-line caliber, the manufactory has been reinforced by additional operators and steam propellers in order to considerably increase the annual output.

The Sestrorietsk manufactory was founded by Peter the Great in the year 1721, and in 1724 it began already the making of guns. It has machines as perfect in construction as those of the Tula manufactory, and is moved by 14 water wheels yielding 300 horse power. The output of this factory has amounted in late years to 70,000 guns per annum, and if some of the minor parts could be worked elsewhere the production could be doubled. The Izhevsk factory, which was founded for iron works in 1763, began the making of guns about 1807. This manufactory uses its own steel, cast steel and Marten steel. It has 8 water wheels and 8 turbines, yielding altogether 520 horse power, and 7 steam engines yielding 675 horse power. For working steel it has one Marten furnace and 21 casting furnaces. The number of hands employed is about one thousand. The production of this factory in the years of the greatest demand for guns, as in 1878 for instance, amounted to 168,455 pieces. The Izhevsk and the Sestrorietsk works, as well as the Tulska, are now turning out a large number of guns of the new 3-line caliber, and therefore they are greatly reinforced in their technical departments.

The enlargement in 1872 of the cast steel works at the Izhevsk manufactory rendered a great service to the Russian armory in that it did away with the necessity of importing steel barrels and cases. This manufactory supplies with steel of the best quality not only gun manufactories but also many other technical establishments working for the artillery. It would be desirable to attract the attention of the manufacturer to the fact that this steel would be of great use in the making of me-

tallic goods, especially knives and tools, and therefore means should be employed to propagate it as much as possible.

As to hunting guns, they are mostly made in Tula and its neighbourhood by the former Crown smiths, some of which have regular workshops. These factories, when turning out very ordinary guns, give out the several parts to be made by special smiths and these parts are merely put together at the factory itself. Hunting guns are made by hand in the villages near the Izhevsk manufactory and in the Belomorsk Korelia, government of Archangel, as well as in Tula, the Archangel guns being exclusively bought by the northern governments where, on account of the immense forests, hunting holds a prominent place among the industries of that people. Principally because the quality is not satisfactory the prices of hand made guns are generally very low, varying from 3 to 10 roubles each, sometimes even falling as low as 1.50 roubles; on the other hand certain well made and finely finished guns are sold as high as 200 to 300 roubles each.

There are few private gunmakers in Russia; they are mostly centred in St. Petersburg, Warsaw and other large towns and in the Caucasus. The output of these works is not large, although the quality of the guns is in many instances not inferior to those of renowned foreign firms. The cause of the small production of these hunting guns is due to the fact that they do not yet enjoy the confidence of the general customer, and sportsmen prefer to pay high prices for celebrated makes. It is stated that 500 hands are employed in the region of Tula in the making of hunting guns and pistols to the value of 150,000 roubles; in the government of Viatka the production of the principal workshops amounts to 13,000 roubles and with that of the small makers it even reaches 30,000 roubles. Two such works in Warsaw sell guns to the value of 22,000 roubles yearly.

The production of the village industry of hand made hunting guns and pistols, added to that of the town makers and to that of the Crown manufactories which, as was already mentioned, also make hunting guns, amounts to 400,000 roubles per annum. It is very difficult to state the amount of the import of hunting guns, which are generally very expensive, as compared with the home production, for the reason that the customhouses do not give any definite information upon the subject.

The following table shows the general weight and value of the firearms brought into Russia from abroad and from Finland, mostly for private customers, as well as of the cartridges and different hunting accessories. The data of the customhouse show, for example, that from 1890 to 1893 there were imported through the customhouses of Moscow, Warsaw, St. Petersburg and Reval, for private customers, 19,275 guns and 144,145 revolvers, most of which went to Moscow. As according to the customhouse tariff the duty for the packing cases is the same as for arms themselves, their weight is included in the total. The table shows the export of arms, firearms as well as side arms side by side with the import, the customhouses giving only general information relating thereto.

Y E A R S.	I M P O R T.		E X P O R T.	
	Firearms and accessories.	To the value.	All kinds of arms.	To the value.
	Pouids.	Roubles.	Pouids.	Roubles.
1885.	5,879	578,431	226	4,145
1886.	6,325	587,713	15,692 ***	1,369,875
1887.	4,724	624,614	28,121	1,230,235
1888.	4,063	558,715	220	72,619
1889.	4,567	582,659	1,058	474,191
1890.	8,820 *	559,649	372	173,510
1891.	6,247 **	562,586	322	141,916
1892.	6,100	562,000	900	156,000

SIDE ARMS AND CUTLERY; IMPLEMENTS FOR WORKING VARIOUS MATERIALS; SCYTHES AND SICKLES.

The articles of this category belong mainly to the household industry; even the factories, particularly those of the cutlers, do not manufacture articles in their entirety, especially the cheaper grades.

The making of side arms and all sorts of cutlery is one of the most ancient industries of Russia. At the Courts of the Princes of old Russia separate blacksmith shops for the production of such arms were established, using imported iron; steel arms, then only used by the *boyars* or noblemen, were wholly brought from abroad, and eastern blades were prized above all others. Even as the manufacture of iron spread in the different localities of Russia the production of side arms increased with that of other wares; after that time Tula and Moscow were conspicuous as the most important points of this industry; already in the sixteenth century there were many good smiths manufacturing even steel blades.

The making of side arms, as exclusively required by the army and rarely needed by private customers, attracted always the attention of the Government which often induced experienced makers to come from abroad in order to develop the industry and perfect the quality of this class of wares. The manufacture of side arms in Russia became firmly established in 1816, when the Kniase-Michailovsk factory was founded in the Urals at Zlatoust, and foremen were brought from Solingen in Prussia who were especially skilled not only in the manufacture of side arms but

* Herein are included 4,812 pouids, to the value of 50,000 roubles, imported from Finland.

** Herein as well as in the total of 1892, according to the customhouse data, side arms are included.

*** The large sums of export for the two adjoining years relate chiefly to firearms imported to Vladivostok.

also in the casting of steel. Steel casting, however, did not reach the desired development while in the hands of foreigners, and only in later years was the industry firmly established by Russian mining engineers. The names of Anossov, who undertook the management of the factory in 1828, and of Obonkhov, who invented a special process for casting steel, will always be remembered in the history of the Zlatoust side arms manufactory, especially with reference to high grade workmanship.

In the beginning of the eighties the forging of swords at this factory was changed to the rolling process; in order to obtain a uniform heating of the blades before hardening, lead baths were used, which lessened the quantity of waste and raised the quality of the instrument. Soon after, Marten steel was used instead of crucible steel, but without any success; then lathes with emery wheels were employed for finishing the blades; moreover the stamping of brass fixtures for side arms and the mechanical work of the wooden stocks were introduced.

The quality of the swords made at Zlatoust is very high even outrivalling, according to the declaration of specialists, the swords of the average quality produced at Solingen. The Zlatoust blades sustain with ease the severest test, namely the strocking on iron, without showing a mark of blemish. Ready made swords and Circassian sabres are valued at 6.50 roubles per piece. At the present time this factory produces, besides swords, table knives and forks with metallic handles in one piece; they are very often ornamented with damascene or engraved designs, which are especially characteristic of the cutlery made at Zlatoust. Moreover, these works produce surgical instruments and joiners tools, as well as files and gun barrels, the latter in only small quantities.

The following table gives an idea of the production of the Zlatoust factory from 1887 to 1891.

YEARS.	SWORD BLADES.	KNIVES AND FORKS.	SURGICAL INSTRUMENTS.	FILES.
	Pieces.	Dozens.	Pieces.	Dozens.
1887	46,997	139	1,047	2,620
1888	37,179	242	1,048	2,340
1889	34,565	275	—	2,880
1890	43,209	352	—	1,960
1891	32,707	520	—	2,030

The production of the Zlatoust manufactory, however, is not limited to the above mentioned wares; besides cast iron and steel projectiles, given in the preceding section of this review, this factory produced during the year 1891, for example, the following quantity of steel goods:

Machinery	12,200 pounds.
Blacksmith and locksmith wares . .	7,200 >
Wares of cast steel	2,800 >

Herein must be included also 1,700 pounds of finished brass fixtures for side arms.

The household industry of side arms is carried on in the village Pavlovo, government of Nizhni-Novgorod, near Tula, and in many of the localities of the Caucasus and in Turkestan. The largest of the factories, with a production amounting to 30,000 roubles yearly, is situated in St. Petersburg. The importation of side arms according to customhouse data has amounted in recent years from 125 to 205 pounds annually, valued from 15 to 25 thousand roubles: thus upon the average import, namely 165 pounds, the value would be 20,000 roubles. The manufacture of cutlery, that is, the making of all kinds of knives and forks, razors, shears and scissors, is chiefly centred in the Gorbatsvsk district of the Nizhni-Novgorod government, and in the Muromsk district of the Vladimir government, where over 80 villages are occupied with the industry.

The origin of this manufacture in the above mentioned region, the centre of which is the village Pavlovo, popularly called *Russian Sheffield*, relates to the second half of the last century, when Count Sheremetev the proprietor of the region, having established iron works, conceived the idea of teaching his peasants to make cutlery, especially fish knives, which were in great demand for the fishing industry on the lower reaches of the Volga. The blacksmith industry had been in existence a long time in the village Pavlovo and in other places of this locality; the peasants were equally acquainted with the locksmith trade, and these facts led Count Sheremetev to believe that the manufacture of cutlery could be firmly established at Pavlovo and in that belief he proved to be correct.

At the present time the neighbourhood of Pavlovo makes all kinds of cutlery, the quality and prices of which are in such variety that they can easily answer to the requirements of all classes, the poor as well as the rich. The high degree of finish of the best knives, especially in the beautiful and durable polish given to the blades, has caused these goods at international expositions to be admired and wondered at, even by English specialists. During the last 15 to 20 years, besides a great variety of wares, a beautiful choice of designs has added to their otherwise fine qualities. Some of the special knives, such as bread knives, cheese knives and butter knives, bear very often handles that are artistically carved and ornamented.

The making of cutlery in Russia, as is also sometimes the case abroad, shows the most characteristic types of household peasant industry with all the peculiarities relating thereto. Thus, even very large factories as has already been mentioned, do not as a rule work all the successive steps in the manufacture, but give out separate parts to special workmen living in villages sometimes at great distances from the factory, some of whom work the blades, others face and shape them, while others again make the handles and still others put the parts together, when the more artistic workmen finish them off. There are villages wholly occupied at some of these special features of the manufacture. The casting of the blades and especially the affixing of the marks are done at the manufactory itself.

The cutlery in Russia is chiefly made by hand. Stamping is sometimes used to give form to the thicker part dividing the blade of the knife or the tines of the fork from the shank or the handle. In the making of pocketknives, the cutting of the small blades is sometimes done by machine; but on the whole, the work is

hand made, although there is a growing tendency to the use of machines instead of the hand processes. For example, one of the new manufactories of the Muromsk district of the Vladimir government has a steam hammer in use for the cutting out of blades and other pieces, and it is quite a novelty in the manufacture of Russian cutlery.

The number of steam motors for turning the grindstones and whetstones, and of polishing wheels has greatly increased of late. In different localities special factories for polishing the wares were established and furnished with steam, and the use of power lathes and wheels is given to workmen for a fixed sum per day. The number of the larger factories and establishments working cutlery is not very great in the region of Pavlovo.

Knives of the best quality are made of cast steel generally imported from Germany and Austria; those of the average quality are made of iron, with an outer plating of steel welded thereto; however, serious efforts are made to use pure steel, made at the Ural factories. Cheap wares are, however, till now made of pure iron or scrap steel, and broken railway springs are eagerly bought by the cutlers for that purpose. Owing to the scarcity of Russian steel especially suitable to this work, as well as to the lack of variety in the sizes of bar iron, workmen experience great difficulties in their trade thus tending to increase the price of the wares.

The following summary of the prices of cutlery of the cheaper grades will give an idea of the very low rates at which the goods are bought by the local dealers from the workmen.

Table knives and forks	per dozen	0.50 roubles
Knives with welded steel plating . . »	»	1.25 »
Pocketknives	»	1.50 »
Razors	»	4.00 »
Tailor shears	»	1.80 »
Common shears and scissors »	»	2.00 »
Barber shears	»	4.00 »
Paper scissors	»	4.50 »
Bread and kitchen knives	per ten	0.60 »

The most ordinary knives, having a very satisfactory quality, made chiefly at the local manufactories, are sold at 2.25, 2.50 and 3 roubles per dozen. Table knives made of cast steel, with handles of white bone, are sold at 5.50 roubles per dozen; the same knives with handles of black wood, at 7.50 roubles per dozen. If stag horn or ivory be used for the handles the prices rise to 18 and 20 roubles, and more if the handles be ornamented. The manufacture of cutlery is divided between different points as follows: the village Pavlovo chiefly produces table knives, razors and to some extent scissors; the village Vorsma, pocketknives; the village Vachi, bread knives and trade knives, as well as the commonest sort of table knives; and the village Tumbotino, shears and scissors.

The total of the production of cutlery solely at the factories and establishments of the Pavlovo region, taken from the data furnished by the proprietors, can be fixed at 750,000 roubles per year. If the household industry and that of the small workmen scattered about the locality in a radius of several versts, their wares being sold to dealers on the weekly markets, be reckoned, the total production must be valued from 1,500,000 to 2,000,000 roubles yearly. Besides the region of Pavlovo a great deal of cutlery is made, as mentioned before, at the Zlatoust factory for side arms, but the wares, being of a very high order, are somewhat dear.

The household industry of cutlery in the other parts of Russia is of little trade importance; it is rather more developed in the Shadrinsk district of the Perm government, where a great quantity of common black and white scissors are made, the black scissors having only the blades polished. The black scissors are sold on the spot from 9 to 10 roubles per hundred; the white, at two and three times as much. Sheep shears are made at the Shouisk district of the Vladimir government and at some other places, but their number does not in the least satisfy the demands of Russia for this kind of shears.

Various kinds of cutlery, chiefly of the common sort, are made in the government of Yaroslav, Tula, Voronezh, Kursk, Novgorod and some of the others, as well as in Siberia, in the Tumen region of the Tobolsk government. But in all of these places the production is very limited and in no way compares with that of the region of Pavlovo.

In all large cities, especially in the capitals, there are establishments making principally kitchen and trade cutlery for butchers, fish dealers and bakers, as also certain compound knives, the handles of which contain other articles besides blades, as cork screws, bodkins, hooks and other useful instruments. Warsaw being rather far from the centre of the cutlery industry and seeing that no household industry of the kind is developed, neither in the surrounding country nor in the whole of the northwestern region, has established several factories the amount of their production being about 75,000 roubles per year. The same can be said also of Riga. In these works, which are organized as regular lock manufactories, the wares are all finished up within the walls of the establishments.

Surgical instruments are generally not accredited to the household industry. Articles of this kind are mainly made in town factories. The orders of the Departments of War and Marine are satisfactorily filled by the Imperial Instrument Manufactory at St. Petersburg, and to some extent by that at Zlatoust. In the region of Pavlovo only one factory, that of Varypaiev, produces surgical instruments.

The Imperial Instrument Manufactory makes various knives and other surgical instruments, to the sum of 30,000 roubles; the private establishments in St. Petersburg, to the sum of 20,000 roubles; those of Moscow, to the sum of 30,000 roubles; those of Warsaw, to 25,000 roubles; and those of Riga, to 15,000 roubles per annum. The average annual value of this branch of industry can be estimated at about 200,000 roubles. Thus, the total production of various kinds of cutlery, surgical instruments included, may be reckoned from 2,500,000 to 2,750,000 roubles per annum.

The import of cutlery from 1886 to 1892 is shown in the following table.

YEARS.	WITH ORDINARY HANDLES.		WITH EXPENSIVE HANDLES.	
	Quantity in pounds.	Value.	Quantity in pounds.	Value.
1886	2,433	145,934	129	23,753
1887	2,607	101,202	151	23,228
1888	1,956	103,775	92	17,141
1889	2,898	155,402	149	25,984
1890	2,888	149,406	177	36,092
1891	3,149	146,333	218	18,087
1892	2,000	111,000	200	22,000

On comparing the value of the import with that of the home production, it may be seen that the latter forms only 5 to 7 per cent of the former. But if the imported goods be reckoned per dozen, the result will show that their quantity is very insignificant as compared with that of the yearly home production, the imported knives being very expensive. The same cannot be said regarding the hand instruments and tools of all kinds used at the factories, manufactories and trade establishments, a great quantity of which are imported.

The ordinary joiner and carpenter tools are chiefly made at the cutlery establishment of the Pavlovo region; the orders executed there lately for the Department of Marine, which furnished excellent models, had a very beneficial influence upon the forms and quality of the wares produced. Axes, being implements very generally used, not only at house building where wood is chiefly employed especially in the small towns and villages of Russia, but at all the peasant household works, are made at many localities, the Pavlovo region being again first among them. Besides this place, the making of axes forms from long ago a prominent industry of the town Ostashkov and of the village Mouravievo, near the town Rzhev, both in the government of Tver. The axes made at Mouravievo have always been highly prized even on foreign markets. In Ostashkov a great manufactory, belonging to a merchant named Mossiaghin, produces yearly many tens of thousands of axes and having well established storehouses, is able to extent its trade far beyond the limits of the Tver government. The manufacture of axes is also highly developed in the governments of Vladimir, Tula, Yaroslav, Novgorod, Voronezh, Viatka, as well as in Finland and Siberia, in the region of Tumen, government of Tobolsk. The prices of axes vary according to their dimensions and quality, from 20 to 100 roubles per hundred.

The import of ordinary joiner and carpenter tools is generally small, chiefly lumber saws, the home production of which would be too expensive owing to the fact that instrument sheet steel is very expensive and little made in Russia, augers are also imported in considerable quantities. As to locksmith tools, files being of first importance, their production is placed on a lower footing than the tools of the joiner. Machine shops and lock factories generally buy only the

requisite assorted instrument steel and make chisels and other tools thereof at the works themselves.

The cutting of files, as of implements very much required in the working of metals, is very often done at the metal working establishments themselves, but as the quality of these instruments, especially with regard to the straightness of the body, is far from being satisfactory, even the most distant manufactories, as those of the Urals, for instance, have to bring them from abroad, chiefly from England. The home production of files, as an independent branch of industry, dates only from the fifties, when because of the Crimean war import was very difficult. The peasants of the Pavlovo region were first to introduce this kind of goods, and the industry has continued active there until the present day, developing little by little but not with the rapidity that could be expected, owing to the scarcity and expensiveness of the steel required in the manufacture. However, of late years, the making of instrument steel has greatly increased at some of the Ural works; the Putilovsk manufactory at St. Petersburg has also begun to produce it, and probably other factories will follow; therefore there is every reason to expect that the manufacture of first class files will in due course be firmly established in the Empire.

The Izhora manufactories at Kolpino, belonging to the Admiralty, using since 1888 files made by peasants (koustars), coarse cut as well as fine, of the average length of six to twenty inches, have been able to compare their respective qualities with those of the files made in England. The data given on the manufacture of files at that factory show that this branch of industry cannot as yet be regarded as firmly established, in as much as the files are not always straight nor uniformly tempered, so that there is great loss in the manufacture; however, for the past few years the industry has shown great progress and improvements have also been made in the tempering, shaping and cutting processes. The comparative tests made of the files of two Sheffield firms and of the Russian files of the same length, 18 inches, and of the equally coarse cut, proved that for the filing of cast iron the Russian files were as good as the English, but for the filing of iron they are inferior. The test consisted in weighing the file dust taken from the metal by the same man during three and three-quarter hours. The chemical composition as seen by the analysis made shows no great difference. The price of the Russian files of the length of 10 to 12 inches is lower, and that of files of greater length, higher than that of the English, duty and carriage paid.

Beyond the Pavlovo region the cutting of files has been established in the centres of machine building and of general mechanical industry, as, for example, in St. Petersburg, Moscow, Odessa and some other towns, and also in Tula. Although these establishments are mostly engaged in re-cutting old files, still they generally produce new ones as well.

Reckoning the above mentioned quantity of files made at the Zlatoust manufactory, the general value of the production can be fixed at about 250,000 roubles, including the manufacture of files by the factories and establishments for their own use, as is the case, for instance, at the Kolomensk factory in the Moscow government, and in some others, as well as the re-cutting of old files. This amount is quite insufficient for Russia. The nuts used for cutting the screw is chiefly made by the peasants of the Pavlovo region, but generally in no great variety, nor in great quantities; there-

fore such instruments for manufactory purposes are mostly imported, as well as the vises, which are made in a very insignificant quantity in Russia.

The production of anvils is developed to a considerable extent in Russia; the chief centres of the industry being the Urals, the district of Cherepoviets, government of Noygorod, the Pavlovo region and Finland. Iron dividers with an arc and set screw and steel tips are made at Tula; over 47,000 pieces are yearly produced there, to the value of 6,000 roubles. The price of such instruments depends upon their dimensions (5 different numbers exist) and finish, and varies greatly; thus, ordinary dividers, coarsely filed, are sold from 9 to 16 roubles or an average of 12.50 roubles per hundred, and polished dividers, from 10 to 20 roubles or an average of 15 roubles per hundred. At Tula there are also manufactured about 10,000 pieces of nut crackers annually, to the value of about 2,000 roubles and over 70,000 pieces of sugar nippers, to the value of 40,000 roubles. Other instruments, as measuring tools and all kinds of mathematical instruments, as levels, planes and the like, are chiefly bought abroad, although their quantity is very insignificant as compared to the total amount of implements imported, files being first among them.

The manufacture of scythes and sickles, implements of prime requisite to the farming industry in Russia, holds the same position as that of tools. Although besides the household works of the peasants many factories are engaged in the production of these wares, nevertheless, the general amount of scythes and sickles made does not answer to the needs of the farmer, especially in the years of good crops. The feeble development of the manufacture of scythes and sickles is due to the small protective duty and chiefly to the scarcity and cost of steel; if these obstacles be removed, the production of these wares would attain great dimensions, without counting the production at the works as labour is cheap and the Russian peasant, occupied from ancient times with the manufacture of scythes, in many of the localities has a vast experience.

The Artinsk Crown manufactory in the Zlatoust district of the Urals has long since established the making of scythes, and in the beginning of the eighties the manufacture of sickles was also introduced, although the latter develops at a slow pace. Using its own steel the Artinsk manufactory could have produced scythes and sickles to a much larger amount. The following figures show the output of scythes at the Artinsk factory for the last six years:

Years.	Pieces.	Years.	Pieces.
1886 . . .	22,664	1889 . . .	49,041
1887 . . .	19,581	1890 . . .	60,340
1888 . . .	40,583	1891 . . .	58,665

The scythes of the Artinsk manufactory are sold at 50 kopecks apiece; they are often found to be too heavy. Recently the works began to use Marten steel in their manufacture. Of other factories the one recently established near Vilno should be mentioned. It is owned by Mr. Possel, is well furnished with mechanical contrivances and produces over 150,000 scythes yearly. The manufactory of Mossiaghin at Ostashkov, government of Tver, producing over 30,000 scythes and 20,000 sickles, the two large establishments in the governments of Viatka and Perm, the yearly

production of which is about 18,000 sickles and 35,000 scythes, and finally, Sonneck's manufactory in Riga also claim attention.

The household industry of the manufacturing of scythes is mostly developed in the village Kharitonovo in the Shouisk district of the Vladimir government; its production amounted formerly to 60,000 pieces yearly, but has greatly decreased of late.

The same can be said of the household production of sickles in the Pavlovo region. It should be noticed that besides the manufactory of Mossiaghin a great quantity of scythes and sickles is produced in Ostashkov, government of Tver, at the smithies of the town inhabitants, and that this industry is widely spread among the peasants of many governments, especially in Viatka, Perm and Yaroslav, and in Finland as well.

The scythe made by the peasants has an iron body with a steel edge welded thereto, which in the best implements covers half the width of the blade. The scythes manufactured at Kharitonovo, when from 8 to 11 vershoks in length, are sold at 25 to 35 roubles per hundred, when from 11 to 13 vershoks in length, at 40 to 50 roubles per hundred. From the given data it can be stated that the home production of scythes and sickles in Russia reaches the sum of 250,000 to 300,000 roubles per annum, while the import of these instruments greatly exceeds this sum.

The import of various hand implements, the surgical excluded, as well as that of scythes and sickles for the years 1886 to 1892 is shown in the annexed table. It should be noticed that according to the classification of the Russian tariff in the column of scythes and sickles, sheep shears, spades, rakes, pitchforks and other implements of the kind for field and earth work, are included. Although these articles, sheep shears excluded, are brought from abroad in no considerable quantities, nevertheless the amount of the import given in the table, if referring only to scythes, sickles and sheep shears, should be lessened about 15 per cent for the years when the crop is good, and 20 per cent when it is bad.

YEARS.	INSTRUMENTS.		SCYTHES, SICKLES ETC.	
	Thousands of pounds.	Value in thousands of roubles.	Thousands of pounds.	Value in thousands of roubles.
1886.	176	1,832	213	1,300
1887.	173	1,881	176	1,219
1888.	205	2,068	203	1,490
1889.	267	2,463	272	2,318
1890.	234	2,209	236	2,018
1891.	204	1,842	208	1,633
1892.	214	1,871	225	1,757

The greatest part of the instruments imported comes from Germany; England takes the second place, while scythes and sickles are mostly imported from Austria, chiefly from Styria, England furnishing very few, and in general less scythes than sickles. The export of various instruments, as well as of scythes and sickles, from

Russia is very limited; in the customhouse data it is not given separately, but included in the column of locksmith wares.

On comparing the figures of the table here annexed with those showing the extent of home production of the same wares it will be easily seen that this branch of industry is very little developed as yet. The growing production of steel and the efforts to introduce the manufacturing of special types, including instrument steel, taken at some of the Ural and northern manufactories together with other encouraging measures, gives reasons to expect that a marked improvement, as well as a decided growth of this branch of industry having so great an importance and being so necessary to Russia, will soon be noticeable in the Empire.

WIRE AND WIRE GOODS.

Although wire drawing is one of the industries founded long ago in Russia, its development relates to the fourties, when electric telegraphs were established. The Istinsk manufactory in the Pronsk district of the Riazan government, founded in the year 1719, for iron works was one of the first to introduce the drawing of wire; the household industry of wire drawing had existed already in many localities, the village Besvodnoie situated on the right side of the Volga at 30 versts distance from Nizhni-Novgorod holding a conspicuous place among them; the wire drawn there was used exclusively for the manufacture of fishhooks, the making of which in the village Besvodnoie and in many of the adjoining villages was founded in times immemorial.

The introduction of wire drawing in the Russian iron works was followed by the rolling of thin iron for the purpose. When, in 1863, the right of importing iron duty free given to machine-building manufactories was extended to the wire mills as well, the rolling of thin iron at the iron works did not decrease, and some of them, namely, those situated in central Russia, began to manufacture other kinds than telegraph wire, using imported iron, as it was much cheaper and thinner, a quarter of an inch or 6 mm. in diameter, it being impossible to limit the use of foreign wire when imported free of duty.

The above mentioned franchise, together with the very small expenses of manufacturing such thin iron into telegraph wire (5—4 mm.) brought about the establishment of independent wire mills which used foreign iron exclusively. The markets received a great supply of wire, which began to be used in the manufacture of nails, the production of which grew rapidly towards the seventies and spreading over all Russia excluded even to a certain extent the use of forged nails, the latter forming a prominent branch of industry among the peasants of the village Uloma of the district of Cherepoviets, government of Novgorod, as has been already mentioned. Besides, in the manufacture of nails and tacks, wire was used also in the making of other wares, such as all sorts of chains, latches, clamps and the like.

In 1881 with the cessation of the above mentioned franchise and with the raising of the import tax the following year from 40 kopecks to 1.10roubles gold per poud for all kinds of rod iron less than half an inch in diameter, the position of some of the wire mills became uncertain. On the contrary the iron manufacturers, at whose

instance such a high duty had been levied, began to set up the machinery necessary for the rolling of fine rod iron for which they had previously laid in a good stock of material, and furthermore, they began to fit out their manufactories with new series of rolling machines, raising in the mean time the price of the small rod iron. This advance was greatly felt by the German manufactories, especially by those of Westphalia, they being almost the sole contributors of that kind of iron to the Russian wire mills and nail factories. Not wishing to lose a good market, some of the most renowned firms organized branch factories in Russia on the western frontier, as well as on the shores of the Baltic, furnishing them with the newest machinery. These new manufactories, owing to their vast technical means, soon began to supply the interior market with great quantities of rod iron at extremely low prices. As a result, the Russian manufacturers in no way profited by the great increase in the duty on imported rod, but only succeeded in calling forth powerful and experienced competitors to their speciality. The latter, besides the rolling of iron, began to manufacture nails and other articles of wire in great quantities.

In order to stop the building of new rolling mills the iron manufacturers sent a petition to the Government, in 1885, asking to reinstate the tariff of 1882, that is, the high duty of 1.10 roubles gold only on rod iron of a quarter of an inch in diameter and under. Their petition was accepted, but owing to the great quantity of wire iron already on the market the prices thereof fell considerably, and have thus remained to this day. The low prices for articles made of wire afforded so little profit to the manufacturers, who were obliged to buy rod iron for their purposes, that many of them have closed their works in consequence. Nevertheless, the large manufactories, founded about 1880 and well fitted out in technical machinery, answered very well to the requirements of the Russian industry for this kind of material, and aided the development of various kinds of wares made of wire, until then produced in very small quantities.

The amount of iron wire and wire nails produced by the manufactories from 1886 to 1890, according to the data collected by the Mining Department, is given in the following table.

Y E A R S.	W I R E.	W I R E N A I L S.
	P o u n d s.	
1886	620,838	260,020
1887	1,516,400	636,035
1888	943,197	611,279
1889	353,935	646,153
1890	1,390,516	1,193,300

To the last year's amount not less than 150,000 pounds of wire and over 350,000 pounds of nails, produced from imported iron, should be added. The wire made of steel and cast iron is very little worked in Russia because there is no de-

mand for such materials by the manufacturers who make wire goods. However, in the demand should arise, then the Russian steel works would be doubtless able to furnish it to the wire manufactories, for the general production of steel in Russia, especially of the Marten steel, the best suited for wire drawing, has considerably increased of late years. The comparatively high price of iron and steel in Russia has a great influence upon the market value of wire and wire nails. When foreign wares are compared with the Russian, the difference in the prices diminishes with the increase in the numbers of the wire, the price of labour being much cheaper in Russia than abroad, and the material being of little consideration when very fine wire is ordered.

Brass wire, including wire made of the different alloys of brass, is chiefly made in the regions of Moscow and Nizhni-Novgorod, the Latten and Brass Rolling Mills of Kolchoughin and Co. being the chief representatives of this industry. In the government of Vladimir, where the amount of the yearly production of latten and brass wire is over 30,000 pouds, the wire used for electrical conductors forms a small part thereof. Brass wire, especially of the finest sorts, which are used for the manufacture of wire webbing, is produced in great quantities in the celebrated village Besvodnoie, government of Nizhni-Novgorod, by the local peasants. The general value of the production of brass wire, chiefly of the finest sorts, amounts in this region to many hundred thousand roubles; some observers reckon it at 800,000 roubles, but this figure seems to be rather high.

The wires of special structure, for example, that from phosphureted bronze, are not made in Russia, and therefore must be imported. Some of the manufactories use this ware for wire webbing, and especially for that used at paper mills. The production of the finest sorts of wire is also inconsiderable. These sorts are brought from foreign firms or drawn at the manufactories and establishments using them for weaving. The chemically pure brass wire used for electric conductors, and formerly exclusively brought from France, and in small quantities from Germany, is now made in Russia. Besides the Ural manufactories, in 1887 there was organized a considerable electrolytic factory in the Caucasus, namely, the Kalakentsk, owned by Seemens Brothers, having a dynamo machine yielding 225 horse powers.

The prices for brass wire are generally high in Russia owing to the cost of the metal itself. The production of insulating wire and electric conductors as well as of submarine cables increases gradually, due to the spreading of telegraph and telephone lines and to electric lighting, together with other branches of the electrical industry. The factories and works producing insulating wire are chiefly concentrated in St. Petersburg. The winding of the wire with wool and especially with silk is very frequently done at the galloon factories. The production of different kinds of insulating wire at the establishments of St. Petersburg may be fixed at something over 200,000 roubles per annum.

The manufactories of wire nails, being the chief consumers of Russian wire, are scattered over all the country, as has been already mentioned. The largest firms are, the St. Petersburg Iron Rolling Mill and Wire Manufactory Co., the Moscow Metallic Manufactory Co., (formerly owned by Goujon), Becker and Co. in Libau, the latter having a branch in Koïrany, government of Vilno, the Metallic Manufactory of Hantke and Co. in Warsaw, and the Riga Wire Manufactory. These works pro-

duce, on the whole, from 800,000 to 900,000 pounds of wire nails yearly. The steamboats going from the Baltic to the Black Sea taking a very small freight cargo enable the Baltic factories to send their products even to the Caucasus. The total yearly output of wire nails in Russia amounts now to 5,500,000 and 6,000,000 roubles. The manufacture of cut nails and tacks, bearing great resemblance to that of wire nails, has also greatly developed during recent years; according to existing data its yearly output is over 50,000 pounds, to the value of 200,000 roubles.

Other wares of wire are made also at manufactories and small establishments; they form also a prominent branch of household industry in many localities of Russia among which the first place should be allotted to the village Besvodnoie, government of Nizhni-Novgorod, and its vicinity. In the region of the village Besvodnoie brass wire, as well as iron wire of the smallest sizes, is drawn by means of simple hand appliances, horse power being used only for the making of very thick wire. Chains, fishhooks, hooks and eyes for dresses, wire webbing of different degrees of fineness, and various plaited and woven fabrics used for articles of husbandry and machinery, are also made there.

The largest manufactory for the weaving of wire webbing, owned by Baron Steingel, is situated in Kiev; it uses foreign wire for the finest makes, and the wares produced are justly renowned and widely spread over all Russia. Notwithstanding that the endless webbing for paper mills made by this manufactory was of the requisite breadth, of 4 arshines, and of a high quality and durability, nevertheless, the foreign foremen of the Russian paper mills, probably from habit, continued to use webbing of foreign make. A somewhat large manufactory of wire webbing, and some small establishments of the kind are to be found in Moscow; in St. Petersburg there are only a few small works. The production of all the factories and works of this category, household industry excluded, amounts to 300,000 roubles annually.

Wire cables are made in Riga, St. Petersburg, in the Riazan government at the Istinsk factory and in Kronstadt at the Crown Manufactory; but this kind of manufacture cannot as yet be regarded as firmly established, although wire cables are more and more in demand, especially for mining works. The high prices of the Russian cables, due to the limited production, are retarding the general progress of this branch of manufacture.

Card clothing is manufactured only in Moscow, and by certain comparatively small works and establishments, founded long ago; the amount of their output for recent years is about 150,000 roubles yearly. But Moscow produces only that kind of card clothing used at the wool weaving factories; the cotton weaving manufactories have to bring all such goods as are needed by them from abroad, chiefly from England. The renowned English firm, Horsfall & Co., in 1891, organized a factory for the manufacture of these cards, but owing to the fact that the industry is newly established it is difficult to state whether it will have any influence upon Russian cotton weaving. The same may be said also of the factory of Jacobson recently established in Riga and producing card clothing for wool as well as for cotton.

Wares of wire of the coarser numbers, such as chains for different use, hooks, clamps, braces, handles, helvies, clothes pegs, and other articles of the kind, are made by many manufactories in Russia; the first place among them is held by the manufactory Westphalia in Kovno, owned by Smith Brothers, the quantity of the wares

produced being considerable and in many varieties. The output of this factory, including the making of heel irons for boots and shoes, which is one of its marked specialities, and the drawing of wire, amounts to 500,000 roubles.

The region of the village Besvodnoie, already often mentioned for its mechanical works, holds a conspicuous place in the home production of wire wares; its role in regard to this category of articles is equal to that of the village Pavlovo of Nizhni-Novgorod government in respect to the cutlery wares. Certain branches of the industry in the village Besvodnoie, for instance the making of fishhooks, are mainly if not solely represented there, although these wares have a large importance for the vast fishing industry of the Empire. Wire webbing and nets made in this region also find ready markets in the flour mills scattered on the borders of the Volga, as well as on the farms, where they are used for the repair of implements of husbandry; they compete successfully with wares made in Moscow not only in cheapness, but also in quality, some of the manufacturers being very renowned.

The sea fishhooks are made of the wire of the Nos. 0 to 6; the river fishhooks from wire, No. 8 to No. 23; the heavier wire is generally bought direct at the manufactories; thin wire is partly drawn in the village Besvodnoie. The rods are made not in Besvodnoie itself but in adjoining villages. Sea fishhooks are sold by thousands in packets, their price ranging according to their size as follows.

S I Z E S.	N U M B E R S.	W E I G H T P E R T H O U S A N D. P O U N D S.	A V E R A G E P R I C E P E R T H O U S A N D. R O U B L E S.
Largest	0	4.05	21.00
Medium	4	2.00	7.70
Smallest	6	1.50	5.60

Sea fishhooks are made of 9 sizes, and river fishhooks are of more diverse sizes still; the price of the smallest is about 25 kopecks per thousand, and that of the larger hooks, from 1.50 to 4 roubles per thousand. The yearly production of sea fishhooks, according to official figures, amounts to 600,000 roubles, and that of river fishhooks, to 50,000 roubles. A certain quantity, not very large, of fishhooks is also produced in the government of Viatka at the village Istobensk, district of Orlovsk.

The metallic webbing and nets made in the region of Besvodnoie are of very various kinds, especially the brass webbing, the finest of which contains over 150 threads per vershock. The weaving looms are of very simple construction, their breadth hardly exceeds one arshine, more often less than one arshine. The total production of brass and iron webbing and sieves of various kinds in the region of Besvodnoie is stated at something over 900,000 roubles. It should be mentioned that metallic webbing is also made at the village Stepacheva, district of Klin, government of Moscow.

The manufacture of combs and treddles for weaving looms is also related to that of wire goods; this kind of work is chiefly centred in the governments of Moscow and Vladimir, where, as is generally known, cotton weaving is largely developed. The production of the largest establishments of the kind, situated in Moscow and Ivanovo-Vosnesensk, according to existing data may be fixed at 100,000 roubles per annum.

The total value of the output of wire and wire goods may be placed at about 22,000,000 roubles yearly. The value of import of wire wares for the years 1884 to 1892 is shown in the following table.

YEARS.	W I R E.		WIRE WARES.		TOTAL.
	Iron and steel wire.	Brass wire and wire plated with other metals.	Iron and steel wares.	Wares of brass wire and insulating rods.	Thousands of roubles.
1884.	542,230	614,459	1,355,006	253,113	2,765
1885.	367,463	450,986	1,198,999	244,874	2,262
1886.	197,193	267,797	1,125,252	382,101	1,972
1887.	190,238	130,614	852,114	387,383	1,560
1888.	216,550	132,515	1,062,759	377,204	1,789
1889.	242,019	174,826	1,053,519	454,827	1,925
1890.	213,100	228,251	980,797	496,389	1,919
1891.	227,124	249,818	917,178	567,495	1,962
1892.	235,000	383,000	965,000	376,000	1,959

From the above figures it may be seen that, although the demands for wire and wire goods has constantly increased, the general total of the import has decreased since 1880, especially that of iron and steel wares: therefore, the requirements of Russia for the goods of this category are largely supplied by the home production the value of which is ten times that of the imported wares. If the import be compared with the home production with regard to the quantity or weight the result will be still more favourable to the home manufacture. However, the import of brass wire and goods has constantly increased of late, as can be explained by the defects of the tariff covering this kind of goods; in 1891 the tariff was changed and its beneficial results will soon be seen.

The manufacture of pins, needles and screws may also be considered as related to wire goods. The making of pins in Russia never formed a prominent branch of trade; even as a household industry it has never been widely spread, but was chiefly centred in the trade establishments of the larger towns. The production of pins and hairpins was formerly rather considerable in Moscow and in some of the villages of the Moscow government in the district of Serpoukhov and Podolsk, so that the impor

was, comparatively speaking, not large; but at the present time the making of these articles, especially of pins, has greatly decreased, the foreign manufactories working them on such a large scale, due to very fine machinery, that they are sold so low that Russian manufactories cannot compete in this branch of the industry, especially as brass wire is much dearer in Russia than abroad.

The cost of brass together with the lowering of the prices for pins induced the kustars, as well as some of the town makers, to use all kinds of scrap brass and rubbish in the manufacture; the wire made of such poor material is of very unsatisfactory quality, and in drawing it very frequent tempering is necessary. Therefore, the pins made of such wire are very easily bent, while those of foreign make, where very hard wire drawn without tempering is used, are generally very strong and not flexible. For this reason foreign pins, even if dearer, are still preferred to those of the home make.

The manufacture of needles has been established in Russia a long while, and may be regarded as a regular industry. However, there are some defects in the hardening process, and especially in the boring of the eyes, that should be remedied; if no improvements be made in this respect Russian needles will always be second to the German make, not to mention the English needles, which as yet have no competitors. Moreover, Russia has no steel wire suitable for the manufacture of needles and is obliged to import all such materials.

The largest and the best equipped needle manufactory, owned by Count Plater, is situated in the Dvinsk district of the government of Vitebsk; according to official data its yearly output amounts to 180,000 roubles. The second place is held by the Kolensk manufactory in the Pronsk district of the Riazan government; its yearly production is valued at 90,000 roubles; it is one of the most ancient manufactories of the kind in the Empire; until 1860 it had even been the only one in Russia. If the production of two more manufactories, the one at Goldingen and that at Dvinsk (Dünaburg) amounting to 100,000 roubles be added, then the general output of the needle manufactories may be fixed at 370,000 roubles, not counting the household industry, which is chiefly developed in the Semenovsk and Balakhninsk districts of the Nizhni-Novgorod government, and to some extent in the Serpoukhovsk and Podolsk districts of the Moscow government. The peasants are generally engaged in the making of coarse needles, particularly trade needles in the manufacture of which ordinary iron is used for the body, covered with cementation steel. Needles for sewing machines are, so far as is known, made only at the manufactory of Count Plater.

Reckoning the average factory price of ordinary Russian needles at 80 kopecks per thousand, and their average number at 125,000 net per pound, the quantity of ordinary sewing needles produced at these four manufactories will amount to 3,700 pounds, and including the wrapping papers, to 4,300 pounds. In reality Russian factories are making also special kinds of needles, such as knitting needles, trade needles and the like; therefore, the output of ordinary needles will be about 3,500 pounds.

The import comprises chiefly ordinary sewing needles. The following table shows the import of ordinary needles, needles for sewing machines and all kinds of special needles, such as knitting needles, embroidery needles and the like, from 1886.

YEARS.	SEWING NEEDLES.		SPECIAL NEEDLES.	
	Quantity in pounds.	Roubles.	Quantity in pounds.	Roubles.
1886	1,102	123,093	710	45,502
1887	1,070	126,000	528	42,392
1888	984	127,799	509	38,547
1889	1,072	152,646	630	40,189
1890	1,032	172,170	461	38,114
1891	1,399	129,082	442	35,436
1892	1,000	117,000	1,000	42,000

On comparing the general quantity of needles, sewing machine needles included together with the quantity of smuggled wares of this kind, with the home production, it will be seen that the latter supplies about two-thirds of the yearly consumption in Russia. Finally, screws are made generally at the manufactories, although at Tula and the surrounding villages where mortise locks are made, they form a special branch of household industry.

The largest screw factory is the *Volcano* at Kovno, the yearly output of which reaches 300,000 roubles; another manufactory with a considerable production is situated at St. Petersburg. Although the import of screws is yearly decreasing it is considerable, amounting to 1,000 pounds annually in late years. Nevertheless, it must be borne in mind that the customhouses include under screws all kinds of iron and steel wares having screw cuttings, for example, hooks with screws, rings with screw attachments et cetera.

LOCKS, HANDLES, AND OTHER LOCKSMITH WARES.

The manufacture of locks and padlocks, of the latter especially, forms an ancient industry firmly established in some of the governments of Russia; padlocks are mainly made at Pavlovo and the adjoining villages of the governments of Nizhni-Novgorod and Vladimir; mortise locks are chiefly made at Tula and in the adjoining villages. The village Pavlovo, of the government of Nizhni-Novgorod, was renowned already in the beginning of the seventeenth century for the manufacture of padlocks and since then the production has grown to be predominant at Pavlovo, whence it has spread to the other villages of the governments of Nizhni-Novgorod and Vladimir.

The manufacture of locks in Pavlovo is mostly centred in small establishments of household industry the processes of the work being extremely simple and imperfect; for example, the parts of the lock and its outer plates are generally cut out with a chisel; although as they are generally very similar and their variety not very great, they could be easily stamped out, if only with hand stamping machines, and with much better results. The present process exacts much finish, thus tending to increase the prices. Therefore, in order to sell at low prices small makers do not finish their wares to the extent desired,

thus telling of course against the quality of the goods. However, the locks made at Pavlovo have one especially excellent feature, namely, their parts are all soldered together, thus making them strong. Meanwhile, the greatest quantity of the locks brought to Russia from abroad, especially the German makes, have their parts only fastened together with small rivets, and therefore they fail in strength and durability and are regarded as unsafe.

The prices at the local fair for padlocks worked at Pavlovo are generally not high; they vary not only with regard to workmanship, but also according to the thickness and quality of the iron used for the joints. Those of the highest grade, the so-called Swedish locks are sold at 6 roubles per ten pieces, if their weight be 4.5 to 10 pounds; at 8 roubles, if their weight be 20 pounds; and at 15 roubles, if their weight be 37 pounds. The same Swedish locks, but of more ordinary workmanship, made of lighter iron and weighing 10 pounds per ten pieces, are sold notwithstanding their large size, at 3.70 roubles per ten; there are still cheaper sorts, but the qualities are not good at such prices.

The so-called *konnie* or *Tula* locks, having keys in the form of screws, are sold at lower prices; the cheapest, and also the smallest, known by the name of *korobchati* or *sumochni* are sold as follows: the smallest, weighing 6 pounds per hundred, at 2.30 roubles per hundred; and the largest, weighing 15 pounds per hundred, at 4.50 roubles. This kind of locks is chiefly exported to Persia and Turkey.

The technical side of the manufacture of locks in the Pavlovo region, as well as in other localities working padlocks, for example the governments of Vladimir, Viatka and Kostroma, has attained a very small degree of development. Not only, as has already been seen, the stamping process is not used in the cutting out of the joints and parts of the mechanism, but it is also not used at the making of keys, which are made of different pieces, that is to say, the forged ring, the stem made of rolled sheet iron, and the bit are all soldered together. The cause of such indifferent work is chiefly the poverty of the peasant locksmiths who duly appreciate the value of the stamping machines, but who cannot afford to buy them. There are few workmen among kustars so well off as to be able to introduce any improvements in the trade, as the profits of the workmen of Pavlovo engaged in this business are much smaller than in other branches. Such a state of things, however, cannot last long, and will soon be changed with the help of the trade school established recently at Pavlovo, the workshops of which contain the simplest and most comprehensible mechanical contrivances for the shaping of all the parts of the lock. Notwithstanding the low prices, the yearly output of the locksmiths in the Pavlovo region reaches from 500,000 to 600,000 roubles.

The manufacture of mortise locks, centred in Tula and its neighbourhood, is in a much better position, therefore the quality of the wares is of a higher order, not inferior to that of the wares of foreign make. Besides the kustars (peasant smiths) mortise locks are also made at manufactories furnished with mechanical contrivances and having steam motors.

Locks, handles and braces are often made in the same villages, whose number in the Tul'sk and Novosil'sk districts, amounts to 130, thus showing how widely the industry is spread in that locality. Of the manufactories, judged from the amount of

output, the largest is that of Mrs. Teplov; it not only works locks, but also other kinds of locksmith wares, such as hinges, bolts, handles and the like, as well as different stove appliances. According to official data the yearly output of this factory amounts to 71,000 roubles; the sum must, however, be regarded as something under the actual value, as for 5 or 6 years past the production reached 100,000 roubles, and since then the output has not decreased, but on the contrary has increased very much, hand processes being replaced by machinery, as for instance, in the making of hinges. Another rather large manufactory, with a yearly output of 60,000 roubles, is owned by Batashev Brothers. The other establishments of the kind are great in number but not in the quantity of production, which may be placed altogether at 100,000 roubles per annum.

The manufacture of mortise locks at the factories, as well as in village workshops bears the character of a household industry. The works are not so much engaged in the finishing up of the goods, as in preparing the different parts, which are cast, stamped and forged. These parts with bars of iron and brass of the length required are then given to the village workmen, who put them together. The manufactories do the sorting of the goods produced by the village workmen, generally with great severity, put their own marks upon them, after finishing them up, and then pack them for the trade.

The village smiths, even those who work for themselves, always buy the forged, stamped and cast parts of the lock at special establishments and then only do the filing and putting together and fixing them in the lock casings, which they themselves make. The making of keys forms a separate branch of industry. Only small keys are forged by hand, the work being generally done by means of stamping machines.

Keys are stamped of seven different sizes, from Nos 0 to 6 and the prices of the smallest, middle sized and largest per hundred are as follows:

No. 0, length 3 inches, 10 pounds of iron per hundred.	. . .	1.80 roubles
No. 3, " 2 " 5 " " " " " "	. . .	1.10 "
No. 6, " 1 ¹ / ₄ " 2 ¹ / ₂ " " " " " "	. . .	0.80 "

Special locksmiths buy keys from blacksmiths and then finish them off by filing and polishing them, with two or three sets of emery. Ready made keys are sold by them to the regular smiths at the following prices per hundred: No. 0, at 5 roubles, No. 3, at 3.50 roubles, and No. 6, at 2 roubles.

Besides the different kinds of mortise locks, such as door locks, generally called *palatni*, cupboard, table, box and chest locks, padlocks to some extent are also produced in the region of Tula, their prices being from 3 kopecks to 5 roubles apiece. Of the padlocks the most remarkable are the so-called French locks, which have sometimes a hidden keyhole and are generally of a very complicated type and of such finish and shapes that they do not differ much from the foreign original; their prices are not high, from 1.25 to 4 roubles apiece. Little brass padlocks also form a speciality of the Tula smiths; they are sold from 4 to 50 kopecks each. Door locks are also made of the French pattern; their mechanism generally includes clasps, on the number of which depends the price.

The door locks made in Tula are of three different types and each type is divided into three sorts, plated with latten, without latten but polished, and thirdly only painted: each sort has 7 different numbers, so that the assortment of the door locks alone includes 63 separate numbers. The locks for other uses are also divided in many sorts according to their finish and dimensions; thus, the quantity of locks made in Tula forms a considerable amount, and their prices are from 10 kopecks to 3 roubles and more each.

Passing the detailed examination of the technical side of the manufacture it should be mentioned, however, that the method of work based upon the division of labour has a great influence on the quality of the goods produced. In fact, as has already been mentioned, the ordinary Tula locks being very cheap are nevertheless of a very good quality, exceeding by far the padlocks made at the Pavlovo region. The earnings of the Tula workmen as well are far greater than those of the workmen of the Pavlovo region. Many thousand people are engaged in the making of locks in the Tula neighbourhood, and the sum of the production may be fixed at not less than 3,000,000 to 3,500,000 roubles per annum.

Other locksmith wares, such as hinges, bolts, door knobs, window fastenings, and the like, are made in Tula, as well as in some villages, sometimes together with locks, but always by special makers. The prices of these wares vary greatly according to their quality and dimensions. Thus, for example, the cheapest sort of painted hinges made of light metal and often even of old iron, is sold at 80 kopecks per four hundred, if the length be one and three-quarters inches, and at 2.25 roubles, if the length be 3 inches, their weight being from 10 to 30 pounds; the hinge rod is not made of wire, but of rolled sheet iron. Hinges of the best makes, with wire spindles, if of the same dimensions as the former, are sold from 5 to 10 roubles per four hundred pieces; for the making of such a quantity of the smallest sort, 30 pounds of iron and 8 pounds of wire are used, and 2 pounds of iron and 12 pounds of wire for the largest. The best hinges are plated with latten and highly polished. Now that the *spingalet*, a sort of full length window lock, is largely used over all Russia; their manufacture has been introduced in Tula, as well as in some other towns, especially in St. Petersburg, Warsaw and Odessa.

The quality of the Tula wares, as also that of the locks, is very satisfactory and their prices, very reasonable. The total value of this kind of goods, the production of stove appliances included, may be fixed at not less than 1,000,000 to 1,500,000 roubles yearly.

In addition to Tula the making of this kind of goods forms a part of the household peasant industry in the Vladimir government, although the extent of the output is not particularly large, and painted wares are exclusively made.

The making of locks and other locksmith articles, as a branch of manufacturing, dates only from 1886 and 1887 when such works were established in the Baltic regions. One of these factories, situated in Mitau, government of Courland, produces door and window appliances to the sum of 30,000 roubles yearly; the other, in Riga, government of Livonia, manufactures locks and small locksmith wares to the value of 76,000 roubles annually. These works are supplied with machinery and all the work necessary to their manufacture is done within the walls of the establishments.

Finally, it should be mentioned that locks are also made in a great number

of town factories, but which generally make them of more complex systems and chiefly to order; such locks, being sold per piece, are somewhat dear and the quantity of them worked by the different shops is inconsiderable. Their prices according to the size and combinations vary from 5 to 15 roubles per piece. The chief customers of such establishments are the owners of storehouses and shops.

The quantity and the value of the import of locks of different kinds, with the exclusion of brass locks, which since 1886 are regarded as brass goods, are shown in the following table.

YEARS.	WEIGHT MORE THAN 5 POUNDS PER PIECE.		WEIGHT LESS THAN 5 POUNDS PER PIECE.	
	Pounds.	Roubles.	Pounds.	Roubles.
1886 *	--	—	13,630	236,201
1887.	2,849	40,105	3,443	71,068
1888.	2,217	32,988	3,035	59,323
1889.	1,747	25,779	6,084	102,416
1890.	720	13,975	6,386	102,462
1891 **	—	—	6,929	111,237
1892.	—	—	6,000	104,000

The growth of the import noticeable in recent years relates exclusively to small locks, which are brought to Russia from Germany and sold mainly in the western region. The prices of these wares are generally very low, therefore they are readily bought, but the quality is very unsatisfactory. The locks imported from England and France belong to the category of compound locks and, although comparatively dear, are of the very best makes.

The locks for safes must be also related to the category of locksmith wares. They are generally made at the establishments where the safes are manufactured. These articles requiring very minute workmanship are made not only at large locksmith establishments, but at some of the manufactories as well. The quality of the safes made in Russia is quite satisfactory, although their prices are higher than those of foreign makes; the same true, also, of the other locksmith wares; still, safes are very seldom imported.

The comparative expense of the locksmith goods produced by Russian makers depends greatly upon the fact that machines for working the metals are little used, while the employment of such means is constantly increasing abroad, especially in Germany and in France. The Russian establishments use equally seldom the stamping process when shaping the different parts of the lock; this also has an influence upon the expense of the wares. Finally, the comparatively small production of malleable

* These figures include all varieties, brass locks as well as all kinds of screws.

** Since 1891 the locks of both categories, as well as screws, are given in the same customhouse data; the figures for the years 1887 to 1890 relate to locks only.

cast iron, used with such success abroad for the manufacture of various small articles, such as harness, stirrups, spurs and the like, must also be considered as unfavourably influencing the price, as well as the variety of the wares made by the locksmith in Russia.

This industry comprises such a great quantity of articles and in such enormous variety that they are not easily classified. Therefore, it is very difficult to state even approximately the extent and value of this branch of industry. However, it may be safely reckoned at not less than 15 million roubles annually.

The import of locksmith wares is estimated at something over 2 million roubles, as can be seen by the following table. In the column of export, according to custom-house statistics, not only locksmith goods, but all kinds of iron and steel articles are included, such as blacksmith wares, kettles, wire and wire goods, cutlery, zinc and lead manufactures. as well as scythes, sickles and all kinds of instruments.

YEARS.	WEIGHT MORE THAN 5 POUNDS PER PIECE.		WEIGHT LESS THAN 5 POUNDS PER PIECE.		IMPORTED THROUGH THE EUROPEAN FRONTIER.
	Pouids.	Roubles.	Pouids.	Roubles.	Value in roubles.
1886	445,099	2,870,076	46,853	706,787	180,000
1887	234,737	1,406,802	46,771	588,219	550,000
1888	337,921	2,857,845	43,847	506,853	390,000
1889	302,589	1,597,804	55,395	603,459	560,000
1890	272,062	1,588,823	45,109	625,161	260,000
1891	211,141	1,703,490	52,823	568,823	500,000
1892	239,000	1,623,000	42,000	469,000	690,000

The figures of this table do not show any considerable fluctuations with regard to the more heavy wares; but a tendency to decrease is noticed; it can, therefore, be stated that the interior demand for such kinds of goods is amply supplied by the home production, notwithstanding the growth of the population.

As a quite new branch of industry, recently established in Russia, the making of steel pens should be mentioned; they are made at the Moscow factory, founded in 1887, by Kroutovski, the output of which is about 50,000 boxes yearly.

The data given in the above review show that the total amount of the metallic wares produced by all the manufactories, trade and household establishments may be put approximately at 120 million roubles per annum, excluding, however, army supplies.

According to the same data it is possible to state the dimensions of the demands of Russia for metallic goods of the groups above reviewed, with the exclusion of equipments for the army and other arms, and to see to what degree the home production in its present condition can satisfy these demands. The following table answers fully the above questions; the figures of import and export relate to 1892.

KINDS OF WARES.	HOME PRO- DUCTION.	IMPORT.	EXPORT.	HOME CON- SUMPTION.	SUPPLIED BY HOME PRODUCTION.
	In thousands of roubles.				Per cents.
Gold and silver goods. . .	7,000	809	282	7,527	94.3
Wares of brass and its alloys	16,000	1,874	280	17,594	90.9
Wares of zinc, tin and lead	8,500	348	—	8,848	96.0
Blacksmith wares, iron and tin	27,500	1,511	—	29,011	94.8
Cast iron and cast steel.	21,000	199 *	95 *	21,104	99.5
Cutlery	2,425	133	—	2,558	94.8
Implements and tools . .	500 **	1,871	—	2,371	21.1
Scythes and sickles. . .	275	1,757	—	2,032	13.5
Wire and wire goods . .	22,500	2,117	—	24,617	91.4
Locks and locksmith wares	15,000	2,396	692 ***	16,704	89.2
Total in millions . .	120	13	1/3	132	91

The data relating to the present condition of the metal industry in Russia, not including machinery, all kinds of apparatus, appliances, materials for ship building and for all sorts of conveyances, lead to the following conclusions:

1. The manufacture of war appliances chiefly made at the Crown manufactories, although private factories work also some such articles, has attained a high degree of perfection, not inferior to that of the best foreign works.

2. The manufacture of cutlery, the casting of bells, the making of silver wares and of most of the wire goods, must be regarded as among the most successful branches of the industry, supplying largely the home demands.

3. The fabrication of locks is well established although the manufacture of mortise locks and padlocks, owing to the poverty of the workmen, is rather poorly developed; this industry, even if it retain its household character, always tending to cheapen the goods, is capable of great development, especially if it were managed by more well to do persons.

4. The making of ordinary brass and locksmith wares, as well as that of enamelled plate, tin and zinc goods, is on the whole satisfactory, although the manufacturers should direct their attention to increasing the use of technical machinery, such as the stamping apparatus, and to the producing of a greater variety of makes. As much may be said with regard to bronze, in as much as the production of ornamental bronze goods, and of articles of the fine arts, leaves much yet to be desired. Other wares of bronze used by bookbinders and joiners are, as yet, only of second grade.

* These figures show the value of the import according to customhouse data.

** The approximate amount of the output.

*** Including the export of tin wares, amounting to 6,000 roubles, according to the statistics of the customhouse.

5. The manufacture of blacksmith wares is in a satisfactory condition, but a more general use of the stamping process is desirable.

6. The production of scythes, sickles, and other implements, is in a very poor position, being unable to satisfy the home demands. The quality of the wares, especially of those produced at household establishments, leaves also much to be desired. The scarcity of steel and the defects in its quality, are greatly retarding the development of this branch of industry so necessary to Russia.

Finally, it must be said that in order to attain a high degree of perfection in the manufacture of metallic wares, Russia must produce the metals of first importance, such as iron and steel, in more various assortments than at present, especially in the works situated in the Urals.



CHAPTER X.

Machines and Implements.

THE manufacture of machines in Russia began in the end of the seventeenth and in the beginning of the eighteenth centuries by the construction of apparatus for the mining works then established, due to the iron will of Peter the Great, which never weakened before any obstacles whatever when the honour and welfare of Russia were at stake. The manufactories founded by him at Olonets not far from St. Petersburg, and having an easy communication therewith by water, furnished the Russian army and navy with guns and other equipments, and served at the same time to introduce technical inventions; the articles made at these factories served as models to those that were established later.

The gifted coadjutors of Peter the Great in the introduction of the mining industry, which was closely followed by machine building in Russia, were Henning, a foreigner, and the blacksmith Demidov, the founder of the still-existing works in the Urals, which bear his name. In 1786 a Scotchman, Haskoyn by name, who was induced by Catherine the Great to come to Russia, established new works in the region of Olonets with the help of the local foreman Yartsov. In this manufactory the founding of cast iron guns and the mechanical processes relating thereto were introduced; and in 1790 the first Russian steam engine of the Watts pattern was built. With the aid of Haskoyn, the Crown foundries were built near St. Petersburg; these works developed later into the great establishments known as the Cronstadt and the Izhora machine works, which are until now supplying the different needs of the Russian navy. The Izhora factories among other works produce at the present time steel-iron armor plates.

In 1805 the Alexandrovsk spinning manufactory was founded in St. Petersburg; it was for a long time under the management of Wilson, who had supplanted Haskoyn. Although the influence of this establishment upon the development of weaving and spinning by means of machinery in Russia was inconsiderable, still it was here

that the looms for many of the Russian factories were made, when the English Government forbade the export of such machines, lasting until 1843.

The first private machine factory was founded in 1790 in St. Petersburg by Berd. This establishment contributed greatly to the spreading of steam engines and especially of steamboats, Berd having in 1817 received an exclusive patent for their manufacture. It was here also that the making of different appliances, especially machine tools for working metals, was first established. At the present time these works, known by the name of the Franco-Russian Manufactory, belong to a French Co., and are engaged in ship building, in the construction of different kinds of steam engines and boilers, as well as in other works connected therewith.

Of the most ancient machine manufactories the Wilson works in Moscow, founded in 1802 for the making of agricultural implements, must be mentioned, as also the factory of Krivorotov Brothers, founded in 1815, in the vicinity of Moscow, and that of Lilpope and Raw, founded in 1818 in Warsaw, originally devoted to the same purpose; the latter is at the present time engaged in the manufacture of railway cars and accessories. Furthermore, in 1824 there was founded in St. Petersburg by Ilis a factory for building steam engines and kindred machinery.

The movement of Russia with regard to machine building until 1825 was limited to the above mentioned factories, if the mechanical establishments at some of the mining works be excepted, where besides repairs certain new articles were made. It must be mentioned, however, that in the whole of Europe, England excepted, machine building was at the time a recently established and slowly developing industry, due chiefly to the wars, which lasted until 1814.

After 1825 the industry in Russia began to develop, but somewhat slowly, especially in comparison with its rapid growth in other countries, France and Belgium being first among all. The industry was already firmly established and had attained a certain degree of perfection abroad, due to high tariffs. In Russia, however, the import of machinery was duty free, and the protective and even prohibitory tariffs on cast iron and iron, established in order to further the home production, retarded still more the development of machine building in Russia by raising the prices on materials of the first importance.

One of the most celebrated manufactories founded during that period was the Alexandrovsk Crown Iron Casting and Mechanical Works in St. Petersburg, built in 1825. The machines of this factory were prime and served as models, and it often furnished foremen of large experience to other manufactories. Later on, this establishment turned its activity into another channel, namely, the building of the railroad between the two capitals. In 1844 its management was given over to The American Co. in order to found in Russia the building of locomotive engines; but this business could not be then firmly established as there was but little demand for such engines, the railroads being at that time very limited in the Empire. During a period of 24 years The American Co. built in all 200 locomotives, 253 railway passenger cars and 2,700 freight and platform cars. Now this factory is under the control of the Chief Company of Russian railways.

Of the other factories established during this period a somewhat conspicuous place with regard to machine building was held by the factory of Nobel, which worked different kinds of machinery, and by that of the Duke of Leichtenberg, where

the attempt at building locomotives proved still less successful than at the Alexandrovsk works, and which was given over to the railway uniting St. Petersburg to Warsaw. Furthermore, machine building was carried on at the manufactory of Ogarev, now bearing the name of Poutilov, after one of its former owners, an energetic promoter of the metal industry, and of new technical undertakings. At the last-named works some portable engines were built during that time, but in general the industry did not take root there; at the present time the movement of this factory is vast and various; it is rolling iron and steel, especially rails, manufacturing railway appliances and cars, as well as small steamers, torpedo boats and implements of war, especially gun carriages and supplies.

In Moscow and in central Russia the following factories were established during this period: that of Butenop, now owned by Liphardt, for the making of agricultural implements; that of Dobrov and Nabholz, for building various machines; that of Maltsev, for the manufacture of different farming tools, in which the building of railway cars and locomotives was recently established, but soon stopped; that of Shipov, engaged in building steamers, and which supplied the Russian manufactories with steam motors; and lastly, the Sormovsk, founded also for the purpose of building steamboats, and in which it is still engaged, together with the building of railway cars and the making of railway appliances. In the southern part of Russia the building of various kinds of machines was carried on at the Crown works in Lougansk and Odessa, and at those of Zaslavski, of Falk, and of Count Bobrinsky. The Government in order to further the development of machine building organized also in the Urals a manufactory well equipped for that time at Ekaterinburg, which supplied afterwards the local factories with steam and air engines, and machine tools; at the same time machine building was established at the Votkinsk works, now having a very various production, working iron, railway appliances, steamboats, agricultural implements, and locomotives. Some smaller factories for machine building were established during the same period on the coasts of the Baltic Sea and in the region of Poland.

Machine building, until 1850, was chiefly developed and perfected at the Crown manufactories, or where it was aided by subsidies and orders from the Government. Upon the whole, however, the production of the private establishments was feeble, and necessarily so at that time, when machinery was imported into Russia duty free and the prices for iron and cast iron were so high that competition with foreign built machines was always hazardous and often ruinous. According to official data, in 1850 there were 25 private machine factories, employing 1,475 hands, turning out machinery to the value of 423,390 roubles, or 326,857 dollars, reckoning by the exchange of that date. The import of foreign machinery amounted at the same time to 2,315,000 roubles, or 1,787,180 dollars.

Although in the beginning of the fifties some new private works were established, they had however, but little influence upon the development of machine building in Russia at that period as compared with that of the other European countries, which had already attained a considerable degree of perfection. The consequences of such slow progress were plainly seen in the Crimean war, taking place at that time, Russia having neither a sufficient or a competent navy, nor suitable arms for infantry, and in both of these essentials her enemies were well and fully

supplied. Owing to the poor development of machine building in Russia, the Government was compelled to put forth the most extraordinary efforts in order to cover to some extent the defects of the navy and general army. During this period the private manufactories situated near St. Petersburg, with the aid of different small mechanical workshops, built in the space of 14 months, 103 steam engines for the navy, yielding a total of 15,000 horse powers; but such hurried workmanship at manufactories and establishments not properly fitted out for the purpose, of course could not be without many defects of construction.

At the end of the Crimean war, which coincided with the accession to the throne of the Emperor Alexander II, Russia's productive forces began to develop, increasing the demands for iron and cast iron; this demand increased very considerably due to the building of railroads, the development of the navy and the change in the equipment of the army. As the home production of iron and cast iron was not able to supply the growing demands in Russia, in 1857 the Government permitted the import by sea of these metals, and which until then had been prohibited, but with a very high duty thereon, considerably lowered, however in 1859.

Under these conditions, although not furthering the development of machine building to any considerable extent, the number of private machine works, according to official data, rose in 1860 to 92, employing 1,862 hands, the output being valued at 846,215 roubles. During that period the smallest figure of import, namely to the value of 513,505 roubles, was in 1854, as is easily explained by the Crimean war, after which it rapidly increased, reaching in 1859 over 11 million roubles; but in 1860 it decreased again to 8,526,653 roubles and there remained for several years.

The growth of the number of factories during the decade above reviewed, with a comparatively small increase of hands employed, is explained by the fact that in the interior of Russia only small establishments in general were organized, making agricultural implements and machines, besides all kinds of repairs. However, some of the powerful Russian manufactories were also established during that period, due chiefly to Government orders and to the increase of private trade companies; but the production of these works was then not definite.

Of the manufactories founded at that time in St. Petersburg the following are the most conspicuous: the Nevsk, now engaged in ship building, and especially in making locomotives; that of Mackferson, now called the Baltic, engaged in building Men of War; that of San-Galli, which builds steam engines and various other machinery, besides producing cast iron building materials; that of Lessner, formerly established for making printing presses and lithographic machines, and now engaged in the more profitable branch of building steam engines and machine tools for working metals. In central Russia the machine works of Bromley were founded, as well as some factories for building steamboats; in Astrakhan the large workshops of The Caucasus and Mercury Navigation Co. were erected at the mouth of the Volga, the largest of Russian rivers; another factory was founded by The Russian Navigation and Trade Co., on the coast of the Black Sea at Sebastopol, where during the Crimean war the Russian forces gallantly sustained a long and severe siege; at the same time Crown workshops were established at Nikolaevsk at the mouth of the Amour.

From 1860 to 1870 the Government, anxious to further the machine building industry, instituted a series of measures to that end. In 1861 the machine works, run

by steam and water propellers, were allowed to import their iron and cast iron, to the extent required, free of duty. In 1866 an order was issued exacting the home manufacture of all railway appliances, notwithstanding the difficulties that might be engendered thereby. In 1869 a customs tariff for machinery was introduced; but the import of agricultural implements and machines used in the working up of materials employed in cloth manufactories and paper mills, as well as of printing presses, however, was left duty free. The taxes were in general very light, 30 kopecks per pound, 9.57 dollars per ton, of cast iron and iron machinery, and 75 kopecks per pound, 24 dollars per ton, of locomotive engines, brass apparatus and brass parts of machinery. These small duties did not have any great influence upon the development of machine building in Russia by themselves, but when the fact that the franchise granted in 1861 to some manufactories to import iron and cast iron free of duty still remained in force, is considered, another view presents itself. Due to the latter influence, as well as to the growth of railway lines, and to the constant orders from the Crown, the activity of the machine works in Russia visibly increased. The emancipation of the serfs, happily accomplished in 1861 in the name of justice and humanity by the noble hand of Alexander II, also contributed greatly to the promotion of machine building in the Empire. This humane act removed the great obstacle in the way of the growth and development of machinery for agricultural purposes, namely, the gratuitous labour of the serfs, since which time the demand for such machines has greatly increased. Although the feeble local production of machines and implements of husbandry could not satisfy the home demand, and although a large field was opened to the import of such goods, still the increasing demand turned many small factories, which were formerly engaged only in repairs, to the building of new machinery, and formed a somewhat considerable group of works wholly engaged in the manufacture of agricultural implements and without the aid of the Government, which was given only in 1885.

Of the most considerable manufactories established between 1860 to 1870 in St. Petersburg and existing until now, are the Machine Works of Nobel, and the Oboukhovsk Steel Casting and Gun Manufactory; in Moscow, the factories of List, Perenood and Veiheit, for different kinds of machinery; near Moscow, that of Struve, now called the Kolomensk, where at the present time locomotive engines are produced on a large scale, as well as railway cars and various railway appliances; this manufactory also formerly produced portable engines and machines of husbandry. Many factories were established at that time also in the south of Russia; and near the Urals, the Perm Crown Works for manufacturing guns and for casting steel were then organized.

According to official data there were in all European Russia in 1870, 145 private machine factories with 27,117 hands employed, and with an output of 27,391,755 roubles, 16,746,434 dollars, per year. During this time the constantly growing import of foreign machinery raised to 37,576,654 roubles, or 28,987,177 dollars, the foreign exchange of the paper rouble being at that time 77 cents. The period from 1870 to 1880 proved equally favourable to the development of machine building in Russia, excepting such kinds of machinery as were imported duty free. Among the measures favourable to the machine industry, already protected by a customs tariff, together with the franchise of receiving iron and cast iron free of duty, should be mentioned the order of the Government, issued in 1876, concerning the increase of

the taxes levied on locomotives to 1.25 roubles per pound, about 40 dollars per ton, and to 50 kopecks per pound, or 16 dollars per ton, on tenders, and that issued in 1879, ordering that duties be levied in gold instead of paper roubles, the nominal tariff remaining unchanged, thus considerably increasing the duties and leading to a better protection of the home production, as the paper rouble was depreciated.

In 1880 according to official data there were in European Russia already 237 factories, employing 56,105 hands, and their output was estimated at 72,289,200 roubles, or according to the exchange of the paper rouble of that year, 51.46 cents, at 37,228,938 dollars yearly; the import of foreign machinery, although there were some fluctuations during the decade, amounted at the same time to 67,345,477 roubles, or 34,682,900 dollars.

From 1881, machine building in Russia was under still more favourable conditions, greatly protecting its development. The unsatisfactory state of the finances compelled the Government to seek new means of income, among which attention was drawn to the customhouse revenues. The tariff of that year raised the duty levied on machinery; on the machines formerly imported duty free, such as spinning and weaving machines, printing presses and paper mill machinery, the same duty was levied as on all other kinds; only farming machines and implements were admitted free, it being considered undesirable to impose such a tax upon agriculture.

With the raising, in 1881, of the customs duties on iron and cast iron machinery to 80 kopecks in gold per pound, 25.52 dollars per ton, the franchise given to the machine works to import iron and cast iron duty free was also abolished, this measure extending equally to the factories producing agricultural machines, and sacrificing the industry still more to such machinery of foreign make as were imported free of duty. The import of such goods increased, of course, and in 1884 was over one million of pounds, or 25,000 tons. Such an unfavourable condition of the manufacture of machines of husbandry in Russia compelled many of the larger firms to renounce the production of such goods and to turn their attention to other channels.

Further measures of the Russian Government in favour of the development of machine building consisted of a series of orders tending to increase the duties levied on imported machinery and unwrought metals, the latter measure being considered as indispensable for the furthering of the development of the home production. Seeing the increase of duty upon unwrought metals, and taking into consideration the petition of the manufacturers engaged in the making of farming machines, the Russian Government decided at last to install, in 1885, for the first time, a customs duty upon such machines, of 50 kopecks in gold per pound, 20.90 dollars per ton, this duty being later on raised to 70 kopecks in gold per pound, 33.52 dollars per ton. Of course, so small a duty could not have much protective influence; it only prevented the complete ruin of those small manufacturers of this kind of machines whose welfare depended upon the production of such goods, and who owing to local conditions and poor technical means were unable to begin more profitable undertakings. Although these modest workmen, compensating themselves to some extent by the repair of machinery, produce new machines, which find a ready market due to the high price at which foreign makes are sold in Russia, still they are unable to establish the building of agricultural machines upon a firm basis in Russia so long as the import of foreign manufactures is practically free.

The decade 1880 to 1890 was in general not very favourable to the manufacture of machinery in consequence of the instability of the tariff and of the general standstill of affairs due to the painful events Russia had to undergo during this period, and to the solicitude of the Government to bring the Russian finances to a more satisfactory condition, which was influencing greatly the decrease of Crown and railway orders. Owing to these conditions the activity of the largest and most productive of the manufactories was lowered, but the number of small establishments, called forth by the pressing needs of life, increased considerably.

The conditions of Russian machine building at the end of this period with regard to foreign competition were as follows. The custom duties upon the imported unwrought metals were: upon cast iron, 15 kopecks in gold per poud, 4.785 dollars per ton, and upon iron, 40 to 60 kopecks in gold per poud, from 12.76 to 19.14 dollars per ton. The custom duties upon imported machinery were: for agricultural machines, 50 to 70 kopecks in gold per poud, from 15.95 to 20.90 dollars per ton; extra parts of such machines were imported with a duty from 1.8 to 2.4, and in some cases to 5 times that above mentioned. The duty upon iron and cast iron machinery, excepting agricultural machines and locomotives, and upon the extra parts of such machinery, the brass parts excluded, was 1.20 roubles in gold per poud, 38.28 dollars per ton. The duty on locomotives was 1.40 roubles in gold per poud, 44.66 dollars per ton. Brass machinery and apparatus in which brass forms the chief material, with regard to weight, as well as extra parts of such machinery, were imported with a duty of 3.50 roubles in gold per poud, 111.65 dollars per ton. On comparing these duties with those first established in 1868 in paper roubles, it will be seen that they were four times as large, and considering that the duties were levied in gold, six times higher than the former.

The import of foreign machinery during this decade was as follows:

Y E A R S.	I M P O R T.							
	Agricultural machines.		All kinds of machines except those mentioned separately.		Locomotives.		Machines and apparatus wholly or principally made of brass.	
	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.	Tons.	Dollars.
1881	136,678	4,053,220	22,774	7,794,010	—	—	107 *	60,255 *
1883	15,984	2,367,755	30,065	9,948,680	97	59,225	80	52,530
1885	7,837	1,260,320	21,693	5,892,025	403	96,305	113	60,255
1887	5,629	897,130	21,629	6,680,065	177	42,745	177	105,060
1889	9,548	1,523,370	33,516	9,910,145	56	18,540	161	107,605
1890	7,435	1,297,285	31,048	9,124,255	80	35,535	177	125,660

* In these figures the import of locomotives in 1881 is included.

The state of the machine building industry during this period, characterizing its present condition as well, can be seen from the following data on the number of factories and hands employed, and on the value of the home production for the years 1885, 1887, 1889 and 1890.

YEARS.	LOCALITIES OF THE FACTORIES.	NUMBER OF FACTORIES.	NUMBER OF HANDS.	VALUE OF PRODUCTION.	
				Paper roubles.	Dollars.
1885.	European Russia . . .	266	37,918	34,978,000	18,013,670
	Poland	70	4,854	6,372,000	3,231,580
	Total	336	42,772	41,350,000	21,295,250
1887.	European Russia . . .	302	40,701	41,793,000	21,523,395
	Poland.	68	5,405	7,616,000	3,692,240
	Caucasus.	10	410	312,000	160,680
	Siberia	2	302	222,000	114,330
	Total	382	46,818	49,943,000	25,720,645
1889.	European Russia . . .	331	44,360	46,882,000	24,144,230
	Poland.	60	4,908	7,784,000	4,008,760
	Caucasus	10	831	1,076,000	554,140
	Siberia	4	319	416,000	214,240
	Total	405	50,418	56,158,000	28,921,370
1890.	European Russia . . .	338	43,328	42,669,000	21,974,535
	Poland.	57	4,241	5,907,000	3,042,105
	Caucasus	13	1,213	1,131,000	582,465
	Siberia	4	300	204,000	105,060
	Total	412	49,082	49,911,000	25,704,165

Furthermore, some other manufactories, which having other specialities cannot be called machine works, are engaged in the industry; according to official data for 1890, 17 such factories were occupied with machine building, their yearly output amounting to 2,731,000 paper roubles. In order to give an idea of the present condition of machine building in Russia it should be mentioned that the manufactories engaged in this industry were moved by 63 water propellers, and 539 steam engines having 658 steam boilers, the total amounting to 10,990 steam powers.

Of the persons having received technical education and having the management of the manufactories in 1890, there were 221 Russians and 100 foreigners, and

of the managers without any special technical education, 250 were Russians and 51 foreigners. Persons not having received any special technical education generally have the management of small factories, chiefly engaged in the repair of machinery and building of agricultural machines not requiring any special scientific knowledge.

The price of labour varies greatly according to the local conditions, to the kind of work and to the degree of its perfection, from 50 kopecks to 3 roubles and more per day. Locksmiths, turners and workmen, running punching and planing machines, and the like, seldom receive less than a rouble, and generally more than that. On all possible occasions payment per piece takes the place of that per day, to the profit of both parties. Day labour for adults consists of 12, rarely of 10 hours.

After what has been said above, a brief look into the development of machine building in the Empire will prove of some interest, therefore the following table is here annexed to show the activity of the industry in European Russia, Finland, Poland, Caucasus, (Siberia and Turkestan excluded) for the period from 1850 to 1890. The data of 1850 are reckoned as a unit, and in the columns of the succeeding years the coefficients are placed, showing how many times the number of factories, of hands employed, and the value of home production, and that of the imported machines, has increased during these years as compared with 1850.

THE GROWTH OF MACHINE BUILDING.														
1850.		YEARS.												
		1850	1860	1870	1880	1882	1883	1884	1885	1886	1887	1889	1890	
25	Number of factories. .	1	3.96	5.80	9.45	9.36	9.52	10.44	10.64	11.12	12.08	13.24	13.52	
1,475	Number of hands. . .	1	7.19	18.31	31.26	30.37	29.95	28.00	25.71	28.46	27.59	30.07	29.37	
423,390	Value of the home production in roubles . .	1	18.78	64.70	170.40	109.90	100.96	92.47	82.61	92.76	98.71	100.71	100.78	
2,315,000	Value of the import in roubles . .	1	3.68	16.20	29.10	9.03	8.52	9.78	6.21	6.28	6.47	9.70	8.88	

It can be seen from the foregoing that the growth of machine building in Russia is on the average very satisfactory, the slow progress during the last decade being due exclusively to the conditions mentioned above. It should be said, however, that the development of this industry in Russia would have been still more rapid if it could have been earlier protected from the competition of foreign machinery. It would be unreasonable, however, to complain of the results, especially on considering that the Russian Government, having in view the public interest, made every effort to establish

first the manufacturing industry, exacting machinery as cheap and as near to perfection as possible.

Turning to the peculiarities of Russian machine manufacture it should be mentioned that not all the forms are as yet introduced in Russia, and that some of the existing branches of the industry are lacking in perfection and development; many of the others, however, are so satisfactory that they enable Russia to be more or less independent of foreign manufactories.

As agricultural machines will be treated in a special review, those of other categories are only to be mentioned here. Spinning and weaving machines and machinery for paper mills and printing establishments, as mentioned above, have been for a long time imported duty free; a small tax had been levied on them and only since 1885 was it raised sufficiently to enable Russian works to manufacture more liberally the most necessary and simple forms of machinery; but this production is as yet not firmly established, the previous efforts in this direction, as has already been seen, being unsuccessful, and at best leading only to a modification of the work.

Machine tools for working metals are built by many Russian works, the most conspicuous place among which with regard to quality, is held by the factory of Lessner in St. Petersburg, and those of Veihelt and Bromley in Moscow. Machine tools for working wood are made in Russia of such kinds as are more generally used, such as sawing machinery; other machines of this category were seldom made, and their production is very little developed, especially that of planing machines. Machines for working metals in the heated state, such as steam hammers and rolling machines, are successfully worked at the Russian factories. Portable engines, although the duty levied upon them was very small until 1880, had been built even before then at the factories of central Russia, namely at the Ludinovsk manufactory of Maltsev and Co., and at the Kolomensk factory, but with no great success; in 1885 the duty was considerably raised, but still the import of portable engines of foreign make, of new types, combining lightness with power, was found profitable by the dealers.

Steam fire engines are made in Russia but in an inconsiderable number, the demand being not large; the making of steam and hand pumps is developed in many factories. Stationary engines and engines for steamboats have been made for many years and successfully in the Empire, because their weight being great their production afforded competition with the foreign makes. Gas motors are until now exclusively imported; the building of kerosene motors, however, has been established at some of the Russian manufactories.

The construction of locomotives is placed upon a firm footing already; the factories, the Nevsk in St. Petersburg, the Kolomensk and Briansk in central Russia, and the Votkinsk in the Urals, can easily build over 300 engines of the 8-wheel compound system per year. The railway appliances of the rolling stock are also made at some of the factories; of these the Poutilovsk in St. Petersburg, the Kolomensk, Briansk, Sormovsk, and that of Maltsev and Co. in central Russia, the factory of Lilpope near Warsaw, and of the Baltic near Riga, are also making railway cars, their yearly output amounting to over 10,000 freight cars. Railway appliances for the rolling stock are also made at the numerous railway workshops, not reckoned in the number of Rus-

sian factories, although most of the shops of the Russian railways are well equipped and well organized establishments. The making of brass apparatus and brass parts of machinery is also greatly increasing in Russia.

In closing this review of machine manufacturing in Russia it would be unpardonable not to mention that the tariff of 1891, after having been carefully revised, has been ratified by the Emperor, and will still further the development and tend toward the perfection of the manufacturing industry in all its branches. This measure together with the constant solicitude on the development of scientific and technical knowledge shows how much has already been done to advance the productive forces of Russia in general, and to support machine building in particular, which is now protected by the recently established tariff. There has not been sufficient time as yet to feel the influence of the new protective policy, but it undoubtedly can be expected that the prices and the quality of goods produced in Russia, machinery in particular, will soon reach a normal state, owing to the development of the production and to the competition duly following it, establishing proper relations between the consumer and the producer. Such was the growth of manufacture and trade in other countries, and following the unchangeable laws of progress, such will be the course of their further development in Russia.



CHAPTER XI.

Glass Wares.

THE first glass works in Russia were founded 250 years ago during the reign of the first Tsar of the Romanov family, Mikhail Fedorovich. It was at the time when Bohemia was excelling Venetia in this industry and throwing glass goods of excellent and beautiful quality upon all the European markets. The fall of Venetia was approaching, as also the time when the classical industry of that country was to become general, due to the spread of glass workmen over all Europe, to the profit of the contemporary trade of other nations. At the close of that period, namely in the second half of the eighteenth century, the Venetians and Hungarians served in Russia, as well as in other countries, to develop the artistic elements of the glass industry. This important event in Russia was contemporaneous with a general waking up and development of other trade interests.

During the reign of Peter the Great, at the beginning of the eighteenth century, was founded the Imperial Glass Works, and later on, some special branches of the industry were developed, and several other State factories established. Soon after the death of the first Russian Emperor, during the peaceful period of the reign of Catherine the Great, the real beginning of the glass trade was laid on a firm foundation in Russia, and developed by the aid of the higher classes of society, feeling the influence and impetus given to the industry by Peter the Great. Moreover, certain learned men of the Moscow University founded, by the aid of Empress Elizabeth, the predecessor of Catherine, and of the Academy of Sciences, did much to push and develop the industry. In the remarkable awakening of Russian trade and manufacture of that time was seen the character of the epoch; it was in the second half of the last century, in the days of Watteau, Franklin and Lavoisier.

The following remarks on the introduction of glass works into Russia, on the general character of the times, and of the different Russian promoters,² is given by a distinguished writer, who had made a special study of the different trade interests of Russia:

«The second half of the last century was signalized by the development of the glass industry and by the production of the highest grades of wares, such as crystal, Venetian glass, filigree and glass tissue. The principal motive for the intro-

duction was a most sincere and earnest desire to develop the home trade and to raise its standard by joining to it new and related branches of independent industries. With this desire many promoters of that time were thoroughly imbued. Amongst them were some who were possessed of an inborn genius and love of technique; being also endowed with great energy they became powerful movers in the trade development of the Empire.

«The principal characteristic of these promoters was, amongst other things, the capacity of influencing others to take an active part in the development and in the fruits of the new industry as directed by their own labours. Their thirst for activity extended much farther than to the satisfying of their own personal interests; they invited cooperation by publishing articles on the profitable character of the glass trade, by describing their own factories to all comers, and thus exerted a great influence upon the industry. In a word, these men were exemplary promoters, who have left as a noble inheritance their worthy examples to inspire contemporary and future generations».

Amongst these promoters was Ivan Akimovich Maltsev, the principal founder of the best and most ancient groups of Russian glass works. He is also known as the introducer of the beet sugar industry and of engine building in the Empire. The factories of Maltsev, which were first founded in the sixties of the last century, developed and increased during the life of Ivan Akimovich, as also during that of his two heirs, his son Sergei Ivanovich, and his nephew, Ivan Sergeevich, his son having inherited his farther's perseverance and untiring activity in developing factories already established, and in founding new ones. The works of Maltsev are divided into two groups: the original, in the governments of Oriol, Kaluga and Smolensk, and the eastern, in the governments of Vladimir and Riazan. On the other hand, the introduction of the manufacture of artistic glass was favourably influenced by the high education and the love for art of the highest order among a number of people possessing a decided talent for technique; and many establishments were founded in Russia by persons of that class. Simultaneously with the Maltsev works, another glass manufactory was founded by Alexei Nikolaievich Bakhmetiev in 1764, in the government of Penza. This establishment, called Nikolski Crystal Works, belonging at the present time to Prince A. D. Obolenski, was remarkable for its manufactures of especially artistic Venetian glass, some of which has survived till now, and for some ornamental products in coloured glass, as also some imitation of artistic filigree work.

Later on, the conditions of the time and the demands of the market changed. Only that work survived which from the very beginning, or later on, was directed to the satisfying of the more positive necessities of life, and which continued to increase with the change in the character of the markets. Those ancient works, however, in which artistic glass was manufactured, have retained their influence on the entire history of the glass industry. Their traditions, passing from one generation of workmen to another, have tended much to elevate glass manufacture in the different regions, even in those engaged exclusively in supplying the most ordinary demands.

In Siberia, glass works were founded very early. One of the the most ancient manufactories in Siberia, near Tobolsk, in the village Aremzianka, produced glass by the commonest means of that time, with the aid of wood ash and local potash. It

belonged to the family Korniliev, and the last manager of it was Mrs. M. D. Mendeleeff, born Korniliev. After her departure, and after the fire which laid waste the frontiers, this factory was closed. The discovery made by the academian Laxman, in 1764, which was described in a pamphlet in 1795 and which had a great influence on the whole glass industry, was also very early put to use in Siberia. Laxman discovered that sulphate of sodium, which is always cheaper than soda, could be successfully employed in the manufacture of glass. Coincident with that discovery sulphate of sodium was found in Siberia, where it was known under the name of *goudzhir*, in very large quantities in the lakes, and glass began to be manufactured with the aid of this salt. Sulphate of sodium is also found in nature in European Russia, in the government of Astrakhan. A merchant named Shilkin, in the government of Nerchinsk near the lake Chagan Nor, opened the industry in 1781, and later on, Laxman together with a merchant Baranov founded in 1784 new glass works near Irkutsk. Several years after, the Siberian *goudzhir* served as material for the local manufacture of soda and of soap, at the works of M. B. Prang in the district of Minussinsk.

Soon after the foundation of the manufactories of Maltsev the number of glass works increased in Russia very rapidly. The most ancient of them, some of which have till now retained their former places, were organized in the government of Vladimir, the central point between the two principal Russian markets, Moscow and Nizhni-Novgorod. They principally produced glass for table service; the works of Maltsev also made sheet glass which continued for many years in general demand. Later on, a north-central group of factories was formed where the manufacture of window glass became highly developed. That group consisted of works situated near the railroad leading from Moscow to St. Petersburg, in the governments of Tver, Novgorod and of St. Petersburg. On both sides of these two centres, the northern and southern, the manufacture of sheet glass was developed in the far eastern governments, Viatka and Perm, and in the south-east, in the government of the Volyn, where also the industry has existed from ancient times.

Some special branches of glass manufacture were introduced into Russia by some foreigners at the beginning of the present century. The necessity of procuring wares or apothecaries and laboratories resulted in the foundation of a factory for the making of chemical utensils. Such a factory was founded in 1880 by Ruting near St. Petersburg, district of Tsarskoe Selo, in the village Orlino, and till now it has done much to develop the experimental science in Russia. Looking glasses have been made at the Imperial Glass Works of St. Petersburg, at the Crown factory in Viborg, and to some extent at those of Maltsev. They are mostly blown or Venetian mirrors. The founders of private looking glass industry were foreigners, who organized works in Livonia near Yuriev in 1792, and one in the government of Riazan in 1780, called the Kiritsk works. At the present time the last named factory belongs to the family Smolianinov. Later on, the Government works ceased to manufacture looking glasses and the number of private factories have not increased; generally speaking, the industry is but poorly developed in the Empire. Besides the articles of daily necessity, such as white service glass, sheet glass of different sorts, and bottles, the favourite objects of the Russian glass industry are, until the present day, Bohemian crystal, that is, glass of high quality made with the aid of potash and lime, plain and figured, and white Bohemian sheet glass of high grade. The abundance of potash and the

good quality of sand in the different parts of Russia have influenced the development of the industry. As to leaden glass alloys they are principally used for the production of coloured articles of high quality; and clear leaden, or the so-called French crystal, is being produced only of late in some Russian factories.

In 1850 there were in all 200 glass and crystal works in Russia; however, the sum of their yearly output amounted only to a little more than 3,000,000 roubles. In 1870 the output of these factories, the number of which had not increased, was 6,000,000, and in 1879, to 7,800,000 roubles. More detailed information on the Russian glass works and a complete register with names and details may be found in a beautiful book, by Lobmeyr, entitled «Die Glassindustrie, ihre Geschichte und Statistic. Spemann, 1874», (The Glass Industry, its History and Statistics), originally prepared for the Universal Exposition at Vienna in 1873.

The year 1879 which ended the war with Turkey and which was, in general, a very active year, begins a rapid increase in the works of certain Russian factories. Thus, the totals given by the glass works in 1880, amounted to 8,333,333 roubles; in the next year their combined output increased about 1,500,000, as in 1881 according to official figures, the Russian glass trade was valued at 9,884,000 roubles, the total number of works being a little larger than before.

The movement of the Russian glass industry, during 1883 and 1884, may be shown as follows:

	In 1883.	In 1884.
Number of works	In European Russia 196	206
	In Poland 34	30
Number of workmen	18,140	20,919
Total value of the output	10,236,000 roubles	10,310,000 roubles.

During that active period of glass trade, which began at the end of the seventies, the production of sheet or window glass was much developed and perfected. From that time the Belgian method was introduced, as also that of cut glass, and especially, of cut crystal. The activity of the Maltsev factories increased to its greatest extent, as also the output of the Moscow Crystal Works, which formerly belonged to K. Marten, now owned by Duftois, and that in coloured lamps, of the Tver works of Bolotin, in the district of Vyshni-Volochok. The latter has retained the technical traditions of the former celebrated Krougovsk factory, which belonged to prince Menshikov, and was situated in the government of Moscow, district of Klin. In the government of Vladimir, besides crystal and sheet glass, the ancient manufacture of artistic bottles by Kosterev Brothers, and in the environs of St. Petersburg, that of crystal by P. N. Zinoviev rapidly developed. Round about St. Petersburg and, in general, in the northern central region, the production of sheet glass increased and improved in quality, as well as that of service glass, plain and figured. In the west, in Poland, a certain Gordlichka extended his crystal works; factories for making services, bottles, lamp chimneys and shades, were organized and enlarged. Gas furnaces were now used in a much greater number than before, and mostly with regenerators; those of the type of Boezi and Bicheron were not general in Russia. For sheet glass mostly Belgian furnaces of Bieuvé were used, and for bottle making, gas

cisterns, acting continuously. Thus, the rapid advance of the glass industry was not only remarked for the increased quantity of its output, but also for its employment of perfected apparatus and methods, which had a great influence upon the growth and quality of the manufactures.

The following data show the present state of the glass industry in Russia, namely its movement during recent years, from the beginning of the past decade until 1890, as also the output in the different regions:

IN 1889.

The total number of glass works in the Empire was 258, in which 23,225 workmen were employed, of which 18,326 were men, 1,681 women, and 3,218 children. The laws concerning young workmen vary for different glass works. Here the necessity of bringing up hereditary workmen, by handing down the work from father to son, is taken into consideration.

For polishing and for other work there were in all 116 machines, the indicatory power of which was 1,073; of these 46 were water motors, and 70 steam engines, with 72 steam boilers. The yearly production amounted to 11,146,000 roubles.

IN 1890.

The number of factories and of workmen remaining the same, and the total power of the motors having somewhat increased, the total production amounted to the sum of 11,479,000 roubles.

The output of the separate principal regions is represented in the following figures.

GOVERNMENTS OF EUROPEAN RUSSIA.	PRODUCTION IN THOUSANDS OF ROUBLES.	
	In 1889.	In 1890.
Vladimir	1,634	1,778
St. Petersburg.	1,393	1,311
Orel	1,413	1,010
Tver	643	759
Novgorod.	722	867
Smolensk	596	483
Riazan	535	565
Moscow	386	489
Livonia.	370	371
Viatka	201	239
Volyn	198	236
Vitebsk.	80	151
Penza	112	126
Kazan	92	111
Nizhni-Novgorod	119	132

Next come the governments of Kiev and Simbirsk, the total output of each amounting to 90,000 roubles; of Astrakhan, to 80,000, this government having only one factory, producing only lamp chimneys, bottles and apothecary wares, founded in 1887; of Perm, about 80,000; of Ekaterinoslav, 72,000; of Moghilev and Vilno, 60,000 roubles each.

All the governments together produced:	In 1889.	In 1890.
European Russia	9,361,000 roubles	9,618,000 roubles.
Poland	1,455,000 »	1,601,000 »
Caucasus, government of Tiflis . .	60,000 »	64,000 »
Siberia, in the five governments. .	210,000 »	187,000 »
Turkestan, region of Samarkand. .	60,000 »	9,000 »
Total . .	11,146,000 roubles	11,479,000 roubles.

According to the different sorts of goods, the output of the Russian glass works is distributed in the following manner:

IN 1889:

Articles.	Number of factories.	Cost of goods.
Glass for services (hohlglass, gobe- leterie).	57	2,608,000 roubles.
Window or sheet glass (tafelglass, verre à vitre)	104	2,952,000 »
Lamps and lamp chimneys	32	670,000 »
Bottles	98	2,066,400 »
Looking-glasses and plate glass . .	11	1,047,300 »
Other glass articles not mentioned in the foregoing rubric	61	1,801,400 »

There are only three factories where plate glass is made by melting, the total output of which amounts to 500,000 roubles; the other 8, mentioned in the above table, only make plate and looking-glasses.

As to materials used for making glass alloys, the Russian industry has no special methods worthy of mention, except the using of natural Glauber salt of Siberian lakes, in some works of Asiatic Russia, and of natural sulphate in the Caucasus, in a glass factory in the government of Tiflis, as explained in Chapter XIII, and also in the volume on the Mining Industries. In European Russia fabricated sulphate is used for natrium glass. It is imported, and to some extent, prepared by Russian chemical works and is known under the name of *ogarak* or *arkan*. Also local soda is used for natrium glass, as may be seen in the article on Chemical Industry, Chapter XIII, this volume.

The using of potash for service glass of high quality is greatly developed. Fire clay for pots and stoves is partly imported, but is also to be had at home in great variety, and generally of good quality. The supplying of factories with their principal material, fuel, is of the greatest interest. In this respect the Russian

factories are highly favoured. The vast wooded regions in the vicinity of the manufactures, owing to the Governmental control over the forests, have not been extravagantly laid waste, and industrial works now profit by wood fuel in great abundance, although it has grown rather dear of late. Nevertheless, the principal factories, those which control the industry in Russia, generally use gas-generating ovens, which burn wood and are always with regenerators, the object being not to cut down too many trees, but to use as far as possible waste wood, such as dead limbs and trunks, and fallen timber. This waste fuel is sometimes very abundant, and the gathering of it forms an important industry in some virgin forests. Thus, in those of Novgorod, Tver and Orel, regenerative gas ovens for melting glass, and gas furnaces for burning sand may be seen. The cutting down of the trees is, for the greater part of the factories, in close connection with the lumber industry, as only the tops of the trees, felled by the forest owners for building, serve as fuel for factories.

The substitution of coal for wood first occurred in the western governments of Poland, and in the far south, in the region of the Donets coal veins, including the glass works of the Don, and of the governments of Ekaterinoslav and Kherson, as also to some extent near the capitals, in the governments of Moscow and St. Petersburg. The glass works in the far south were principally constructed for the manufacture of wine bottles, for champagne and sparkling waters. Moreover the Moscow factories use a great deal of naphtha residues. In Astrakhan, where the glass works produce bottles, lamp glasses, and apothecary wares, the Baku naphtha serves as the principal fuel. In Samarkand the gas furnaces of the Ivanov factories, where principally bottles and lamps are made, consume pit coal. In the Tiflis works, producing bottles and lamps, gas ovens work by wood generators.

The total consumption of fuel by the 255 Russian glass works in 1890 was as follows: wood, 250,300 cubic sages, or 2,431,000 cubic metres; pit coal, 2,407,100 pounds, or 39,461 metric tons; naphtha residues, 396,660 pounds, or 6,502 metric tons. Moreover, a small quantity of turf, about 650,000 pounds, or 10,656 metric tons, must be added hereto. This turf is used in one of Maltsev works in the government of Vladimir, and to some extent in Poland.

The prices of fuel, varying in different localities, are on the average: for wood, 4 to 7 roubles per cubic sagine, being 2 to 3 kopecks per poud, or according to the average rate of exchange, 3 to 4 shillings per ton; for pit coal, 10 to 14 kopecks per poud, or 14 to 19 shillings per ton; for naphtha or naphtha residues, in the lower parts of the Volga, 5 to 8 kopecks, or 7 to 11 shillings per ton.

The quantity of wood, consumed by the Russian glass works per unit of weight of glass merchandise, forms on the average of all the factories, 10 to 12 parts per 1 part of goods. Here the total consumption of fuel, including the heating of the building and of the steam kettles, is taken into consideration. The largest quantity of fuel is used for the production of sheet glass. Factories producing such glass in common ovens consume the most: thus, for one part of glass, 15 parts of wood are used, including the total consumption. Those which work with gas furnaces consume 11 to 12 parts of wood per 1 part of glass; thus for example, they employ 0.6 to 0.7 cubic sages of wood per box containing 13 pounds of glass. By examining the consumption of fuel for one melting of glass in furnaces, together with the finishing of the batch, it will be found that on the average of the Russian factories the quantity

of fuel consumed is a little greater than the ordinary technical standard, 7 to 8 parts of wood to 1 part glass. This is influenced by the duration of the finishing of the glass, which shows a little irregularity in some of the smaller works, especially in the western region.

The prices of chemical materials used for manufacturing glass, except sand and potash, are higher than abroad, as they are mostly imported. The soda costs on the spot 1.30 to 1.80 roubles per pound; Russian sulphate, 60 to 75, and foreign, 70 to 90 kopecks per pound. The average price, in the different localities, of Russian potash for crystal factories is 2 roubles, and the so-called Warsaw potash, 3 to 3.60 roubles per pound. Potash prepared from ash on the spot, as in some works, costs about 1 rouble per pound. Sand for crystal, brought from a distance, ranges from 7 to 15 kopecks per pound. Some add to common sand Norwegian and Finnish quartz, and pay for it, according to the distance of transport, 25 to 55 kopecks per pound: chalk and lime, from 2 to 30 kopecks; and sodium nitrate, from 2 to 2.50 roubles per pound.

The number of changes in the melting of glass varies in a given time in factories producing sheet glass, and in those which make service glass. These changes occur in Russian sheet glass works fourteen to eighteen times, and in service glass works, twenty to twenty-five times a month. In all good crystal works, each step in the process does not continue more than twenty-four hours, of which the melting occupies ten to twelve hours, and the finishing of the glass, eight to ten hours, no work being done on Sundays. Sometimes the melting of coloured lamp masses, together with the finishing them off, continues only sixteen hours. In the sheet glass industry very often no holidays are taken into consideration, so that the men work 340 days, the number of batches not exceeding 220 a year. Besides the regular working ovens there is always one in reserve in case of need, and therefore the work is seldom stopped.

The class of workmen known as glassblowers was established in Russia long ago; among them there are, as well as in other countries, real artists. The wages they receive are the same as those paid in Bohemia, where a chief workman, *glassmacher-meister*, together with his two helpers and one boy, *lehrebursche*, receives from sixty to one hundred guildens a month, out of which he himself pays his helpers. In the Russian crystal industry a workman, with his two helpers, receives for the making of common tumblers, which have about 250 cubic centimetres capacity and weigh from seven and one-half to eight pounds per thousand and of which the three workmen together can make 700 pieces during eight hours, 50 kopecks per hundred of simple tumblers, 60 kopecks for the first sort and 45 kopecks for the third; consequently from 3.50 to 4.20 roubles for one change of work, or from 80 to 100 roubles monthly. For the making of glasses each work-table, or set of workmen, consists of two chiefs, one helper and several boys; the latter receive their pay independently. The press workmen receive less, namely 40 to 45 kopecks per hundred. In the glass industry the total pay to a set of workmen, consisting of blowers with their helpers, pressers, drawers and others, forms 40 to 60 per cent of the total cost of the manufacture.

In the production of sheet crown glass, the number of batches being 14 to 18 per month, and in those by the Belgian method, the press workmen receive their pay per sheet of glass. A certain number of these sheets form a so-called *bunt*, an old

German measure till now used in Russia for calculating the pay due to workmen, and also in selling window glasses. A work-table consisting of two workmen, who make from five to six cylinders of glass per hour, or at least forty per day, summer and winter, receive from 25 to 30 kopecks per bunt, containing two cylinders of 24 vershocks, or 1.067 metres long, and 9 vershocks, or 400 mm. in diameter each, making five to six roubles per day; or, if there are 15 to 16 such works per month, 75 to 100 roubles monthly. When the cylinders are smaller the pay is also lower. In the sheet glass industry the total wages to workmen forms one-third of the total cost of the manufacture.

The cost of labour in the bottle industry is also from 30 to 35 per cent of the total expense of the production. The number of batches per month in that branch of the glass industry is 17 to 20, if the work is done in pots. In so-called interruptive cisterns without pots, the number is about eighteen or nineteen. In such cisterns as use gas, the melting of the glass and the finishing the work off is done in turns as in ordinary furnaces with pots. The bottles are made exclusively in forms. The melting of glass for bottles in ordinary ovens continues seven hours, sometimes only six, and one hour is given to the workmen for rest. During these six or seven hours a workman makes 350, and some even 400 bottles. In the interruptive cisterns, of ordinary capacity, 9,000 bottles can be made in 12 hours. The work-table consists of three persons: chief workman, his helper sometimes called jar-maker, and a boy. When the work is done in ordinary ovens it is organized otherwise: near each pot, four sets of workmen are stationed, each set consisting of three labourers.

The capacity of the pots used in Russia for melting glass, is as follows: For crystal, and in general for service glass, they contain twenty, seldom twenty-five pounds, or 325 to 400 kilograms of melted glass. The goods made from this quantity of glass weigh from 13 to 16 pounds. In the sheet glass production, dependent upon the size of the works, the capacity of the pots is 20 to 75 pounds. In the latter case the filling of the pot is by degrees, in ten additions, until the pot is full of melted glass, in proportion as the melting material, becoming liquid, sinks. For a pot of such large capacity there are three chief workmen at a time, each having four substitutes. When cylinders of middle size are produced, each workman makes on an average ten per hour, and the whole batch continues eight to nine hours. An oven which has ten pots of 70 pounds capacity each, produces yearly about 5,000 boxes of window glass the number of batches being 15 per month. There are plants containing two such ovens, with one in reserve for emergencies. In the bottle factories the pots are of 30 to 40 pounds capacity, each oven containing 8 to 10. Pots of small capacity, 12 to 17 pounds, are used for melting glass for coloured lamp chimneys and shades, and for special chemical wares. For making plate glass, round pots of 40 pounds capacity and of a flattened form, having a diameter of one and one-half arshines, or 1.066 metres, are used. In the looking-glass works, in the Riazan government, three gas ovens of Siemens pattern, each having 12 of such pots and 24 stoves for hardening the glass, have been working until now.

Service articles in glass are sold in Russia by the piece; sheet glass, in boxes or half-boxes. A box of sheet glass, generally consisting of 20 bunts, averages from six to several hundred pieces of glass of equal size, depending upon the number of

sheets in a pack, as established by the manufacturers in their price lists. The selling price of sheets is not determined by their size, a factor taken into consideration only when the price of the packets which form a box is fixed. For a clearer idea of the prices of glass wares the following figures are given, showing the average market values of a weight unit of such goods without delivery.

Crystal of good quality, in plain, cut, and pressed articles, costs in Russian factories, 9 roubles per pound. For wholesale buyers a discount of 25 per cent is made per barrel. A barrel of crystal costs from 65 to 70 roubles, and contains seven and one-half pounds. Plain services, or figured, of good clear glass of medium quality is sold on the market by the manufacturer at a profit ranging from 2 to 5 roubles per pound.

There are in Russia, although in very small quantities, services made of plain crystal without any designs; they are an imitation of the service glasses of celebrated foreign makes, and are called *Baccarat*, in honour of the renowned French crystal. They are very much like the French leaden crystal as to purity of finishing and form. However, they are made of more practical potash crystal, and only occasionally do they have some lead in their composition. The prices of such services, manufactured only in recent years by one of the factories of Maltsev, average for small and larger objects, 25 to 26 roubles per pound. Thus, for example, large tumblers, which are the cheapest representations of this class of goods, cost 19 to 20 roubles per pound; small tumblers, 24 roubles; and small wine glasses, 31 to 36 roubles per pound. Such services are sold largely in the capitals.

The average price of window glass of high quality, white Bohemian of prime sort, a box of which costs 45 to 50 roubles, averages from 3 to 4 roubles per pound; grayish window glass, fifty per cent less. Ordinary sorts of bottles of pure manufacture cost from 1 to 1.50 roubles per pound. Better sorts of wine bottles cost from 2 to 2.50 roubles per pound; such goods are sold by the hundred, or by the thousand pieces per pound. In Asiatic Russia, where the manufacture of bottles is quite unequal to the demand, the commonest makes were sold recently at 15 roubles per hundred. Such a price is very high, as in European Russia the same sorts can be bought at 3 to 4 roubles per hundred.

The trade in looking-glasses in Russia is much embarrassed by the import of foreign mirrors. These goods, made in Russian factories, are generally of small dimensions, often about one square metre, as the demands for such glasses on the home markets are 5 or 6 times those for large sizes, as explained by the fact that the principal markets try always to supply the wants of the middle classes.

Russian factories, however, produce conformably to their technical means large sizes also, the largest being 6 square metres, as well as the small and medium size mirrors. Plate glass used for windows and doors, as also very thick glass for roofs, is to some extent made at Russian works, such as Amelung and Smolianinov, and in part, imported. Large looking-glasses are also brought into St. Petersburg, very often in the unpolished state, and are then finished off in the local factories.

Plate glass is sold at 2 to 3 kopecks per square vershock, or 10 to 15 roubles per square metre. The trade in small glasses, owing to the low prices of those imported, brings but little profit to the producers. Large looking-glasses, however, are more profitable, as they sell at 6 to 7 kopecks per square vershock, or 30 to 35

roubles, which makes, according to the rate of exchange, 112 to 130 francs per square metre.

The transport of glass goods to the interior of Russia is as far as possible by water; thus, the goods from the group of the Maltsev factories go to the south by the Desna and the Dnieper, and to the east, as far as Nizhni-Novgorod, by the Oka, which passes through Oriol, and rises near the government of Kursk. The other central group of Maltsev factories is still closer connected with the market of Nizhni-Novgorod. Part of the goods transported thence go into Asia, either by the Volga towards the south, or towards Viatka. For that purpose special kinds of goods are prepared, called Asiatic, which consist of many kinds of coloured glass. From the above centres, glass is also transported by rail. The Maltsev factories, of the Oriol group, have their own small railroads, the length of which, including all the branches to the different works of Maltsev, is about 200 versts. Some factories of the western Polish provinces, situated near the principal railways, also have their own private lines.

Goods from the north-central group, the trade centres of which are Moscow and St. Petersburg, and those from the western group parallel to the trade roads which move foreign goods imported over the Russo-Austrian frontier, are carried all the year round by rail. Thus, the principal quantity of glass goods is transported even during summer by railway.

The yearly export of Russian glass by the Asiatic frontier has averaged in late years, from 100 to 200 thousand roubles annually. Some articles are also exported into Western Europe, especially to Germany, and according to official data such export ranges from 200 to 250 thousand roubles a year.

The import of glass goods is very considerable, and has been estimated during recent years, from one-tenth to one-eighth of the total value of the Russian production. The exporting countries are Austria, France, Germany, Belgium and England. The principal and most valuable articles imported are leaden crystal, Bohemian service glass, window glass of large dimensions, and looking-glass.

The following figures show the value of the articles imported over the European frontier:

Years.	Paper roubles.
1886	2,390,000
1887	1,720,000
1888	1,300,000
1889	1,740,000
1890	1,590,000
1891	1,520,000
1892	0,900,000

Estimated according to their trade importance in the capitals, the first place among the objects of import is occupied by plain service glass, not faceted, and by moulded service glass, *verre moulé*, produced by French factories, especially by Baccarat. In St. Petersburg simple service glass costs 12 to 13 roubles gold per pound, containing from 30 to 200 pieces; and moulded, 8 to 12 roubles gold per pound, containing 20 to 120 pieces. This price does not include the customs duties, which are for

plain, 4 roubles, and for moulded, 2 roubles gold per pound; such are leaden glass goods. heavy and strong. Belgian plain half-crystal, such as Val St. Lambert, are also much imported; they cost in St. Petersburg, not including duties, 4 to 9 roubles gold per pound, each containing 80 to 280 pieces. French leaden glass, as well as the Bohemian plain and faceted, which is a little cheaper than the French, is much admired in both capitals; large tumblers cost 6 to 7, and small wine glasses, 10 to 14 roubles gold per pound. Foreign coloured and decorated glass is in much less demand than the plain white. Bohemian crystal of cheap facet is also much imported. The faceting industry in Bohemia is, since ancient times, divided into many branches.

The next article of trade importance is the Belgian plate glass of large dimensions, as also Belgian and French looking-glasses. Window glass costs, according to the size, from 3 to 8 roubles per pound; a looking-glass of medium size, as is generally the Belgian of second quality, is priced at 5 to 6 roubles gold per square metre, not including the duty. The tax on looking-glasses in general is high, and depends on the dimensions of the surface. Thus, when the size of the looking-glass is 1 square metre, the duty is 10 roubles per square metre; if it is two square metres, the duty is 13 roubles gold. and further in like ratio. In the same way the duty on ordinary sheet glass, when the surface is less than 1 square metre, is 1.50 roubles, and exceeding these dimensions, 3 roubles per pound.

By comparing the data showing the cost of the home glass industry with those which give the value of the import, it will be seen that the yearly consumption of glass in Russia amounts to the sum of the two totals, which ranged in 1889 to 1891, from 13 to 14 million roubles a year.



CHAPTER XII.

Ceramics.

THE making of pottery forms from time immemorial one of the most widely spread branches of industry in Russia. The number of potters and grinders possessing special knowledge and able to answer the highest requirements was always great, the pottery trade being one of the household industries, thus not only facilitating the large factories but furnishing also one of the principal motives for their establishment. The variety of articles produced at the household workshops enabled the local potters to be always ready to help the manufacturers in every branch of ceramics. Thus, for instance, when with the development of the chemical products, especially with that of muriatic acid, the demands for special pottery arose, the establishment of the proper works presented no difficulties, having already a practical foundation to work upon. All the conditions and qualities which can be exacted in the ceramic art were united in this branch of the pottery trade. The success of the production depends on many conditions, namely: the mass must be of uniform structure; the finish must be carefully done by hand; the resistance of the material to mechanical force must be considerable; the material must be fine grained, as if fused; it must be proof to change of temperature and strongly baked; the sides of the pots must be comparatively thin, although to a considerable extent they must be fireproof, and the dimensions must be very large. The workmen for the manufactory were chosen among the best potters engaged in the household industry, and they proved to be quite prepared to perform all work set before them.

In such way, for example, the production of stoneware for chemical use was established at the large chemical factory of A. A. Shlippe in the village Plessenskoë in the Vereisk district of the Moscow government, founded in 1825 by K. K. Shlippe, renowned for his chemical investigations. The works for the manufacture of stoneware used at the chemical factory were established there in 1862. In 1890 this factory gave way to other Moscow chemical manufactories, and the firm closed its doors. Another more recent example is represented by the great chemical factory of P. K. Oushkov in Elabouga, government of Viatka, where stonewares are also made.

It must be mentioned that the production of stoneware is by no means less

complicated than that of the white porcelain. In the pottery trade, as has already been the case in many other branches of technical production in Russia, the household industry served as a basis upon which separate manufacturing centres of crockery, earthenware and porcelain were comparatively recently established. The hands employed at such factories were generally the local household workmen. It should be mentioned also that the founders and owners of such establishments, centralizing the trade, came mainly from the midst of the workmen engaged in the household work; therefore, it can be said that the merit of the organization of the earthenware and porcelain manufacture must be wholly attributed to the household industry. Thus, the ordinary pottery trade in Russia claims attention not only as a branch of popular occupation, but also with regard to its connection with the ceramic works established in Russia. Special statistical investigations and works have always been consecrated, and especially in recent years, to the popular manufacturing industry. The photographs exhibited by Mr. Ergemsky at the World's Columbian Exposition at Chicago show in very great variety the samples of the national Russian pottery, they being gathered from different large collections, such for instance as the Museum of Wares of Household Industry in St. Petersburg.

The so-called *Gzhel*, a locality situated in the Moscow government and comprising a group of villages of the Bronnitsk and Bogorodsk districts, as well as some villages of the district of Pokrovsk, government of Vladimir, was renowned of old for the favourable conditions it presented to the development of household pottery. The village Gzhel with the adjoining villages is situated 50 versts distant from Moscow in the centre of the locality having a vast area of clay repositories, known by the general name of the gzhelsk. Here the making of pottery served as a means to enrich clever peasant enterprisers; this locality is rich not only in excellent potter's clay but also in some kinds of light fire clay, good for the manufacture of the average sorts of earthenware and porcelain, for fireproof bricks and moulds.

The white clay (china clay) of the best quality, for the needs of the manufacturer, was brought here from the Chernigov government, namely, from the district of Gloukhov, vastly renowned in Russia for its different sorts of *kaolin*. However, Gzhel itself is rich in fireproof china clay found in the villages Minin, Zhirov, Rechitsy and others. The development of the pottery trade in this region, in the hands of separate enterprisers, ran the following course: having put aside about a hundred roubles, a peasant of Gzhel engaged 2 or 3 workmen and began the making of bricks, the local clays being practically fireproof, and occasionally that of plates, the latter being chiefly manufactured at the household establishments grown to be regular factories. As the trade went on well the making of moulds for baking earthenware and porcelain was established in a separate building, the products being sold to the manufacturers. Thereupon, under favourable conditions, his establishment was soon turned into a regular factory for the making of plates.

This abundance in ceramic materials, united to the good position of the locality with regard to the ways of trade communication with Moscow, with the east through Kazan, and with the southern markets of Kharkhov and Poltava, called forth a strong development of the household industry in Gzhel. The object of the trade in later years, especially in the beginning of this century, was the production of earthen

and porcelain plates, which gained the preponderancy over other specialities of the ceramic trade, such as the making of pipes, melting pots, pots, jugs and moulds for sugar loaves, which were formerly in use. The general character of the earthenware and porcelain trade, developed here in this Russian Staffordshire in the hands of household workmen, depended firstly on the fact that it answered to the needs of the people in general, having like the other branches of the industry in view first the cheapness and practicability of the wares. Plates of the so-called semi-earth, made of local clay in Gzhel itself and glazed with lead, were sold at 30 to 35 kopecks per dozen, and the quality was not bad. To order, such good porcelain wares were so well produced, as for example, at the establishment in the village Rechitsy, that the middlemen, buying them from the peasant makers in Gzhel, sold them as foreign goods, which according to the custom of the times raised their value.

The great production of plates at the factories in Gzhel was followed by the establishment of the painting industry concentrated in special workshops. The manufactories gave the plates to these shops to be painted, the payment therefor being by the piece. Special workshops for preparing paints, used in the muffle painting on porcelain, were also organized. Both of these kinds of workshops, forming branches of the regular factories were founded and managed as those by the peasant workmen, a fact showing plainly with what knowledge and how steadily the trade was organized in this locality. Gzhel is the birth place of ceramics in Russia, but it lost much of its importance with the settling of the industry near large manufacturing centres established in different localities of Russia.

The household production of pottery was in the most flourishing condition at the period from 1830 to 1860; the immense factories of earthenware and porcelain belonging to M. S. Kousnetsov owe their prosperity to the Gzhel, in which this firm has been for many years one of the most important.

The production of *white plates* in Gzhel dates from the latter century and the Moscow porcelain factory of Gardner had undoubtedly a favourable influence upon its development, although there are other data showing that, just at the time when Gardner's factory was founded, porcelain clay had been brought to Gzhel from Gloukhov, government of Chernigov as described in *Materials of Household Industry*, by Meschersky and Modzalevsky, St. Petersburg, 1874.

The decline of the household industry towards 1860 was in a certain degree due to the raising of the prices of fuel in the locality to an extent that made it impossible for the kustars to continue the production of cheap wares with a profit. Thus, in the beginning of this period when all the trades of Russia tended to development and the general activity with regard to large manufacturing undertakings was noticeable, the household industry, centred in Gzhel owing to circumstances, in the hands of its most powerful representatives gave birth to vast manufactories in different towns of Russia. However, the production still continues in the locality of Gzhel in the form of a household industry, having some importance with regard to the making of plates as well as to that of bricks and pipes. The clays of the Gzhel also furnish the necessary material for making pipes, bricks, paving plates and tiles to some of the factories situated in Moscow vicinity; for example, to the large brick and pottery manufactory of the architect S. E. Ovannesianz, formerly that of N. B. Stepanov, 30 versts distant from Moscow.

Besides this typical locality, in which the ancient popular industry promoted the organization of the great pottery concerns of the present day, attention is drawn to the governments of Yaroslav and Tver, especially to the district of Vyshni-Volochek, in the latter district a town of the same name is situated on the railway between Moscow and St. Petersburg; some of the districts of the government of Novgorod, especially the district of Borovichi, the town being a little to the east of the same railway and united to it by a lateral branch, should also be mentioned. Both of these neighbouring localities are situated on the slopes of the Valdai mountain chain, but the quality of their clays, as well as of their production, bears a somewhat different character. The blue, gray, and red clays of the government of Tver are excellent kinds of potter's clay; the gray, white and black clays of the district of Borovichi belong to the best fireproof clays of Russia, in general, and to the best kinds of the clays of the Novgorod government, rich in fire clays. In both these governments the making of pottery is largely developed, the government of Novgorod having special importance, furnishing its fire clay to different Russian manufactories, and producing fire bricks on a large scale.

The history of the development of the trade here is much like that of Gzhel, the household industry serving as a basis for large manufacturing centres, and influencing later on the methods of the household producers. One of the most interesting episodes of such historical development was the establishing of the works of N. A. Gouzhov in the locality situated on the verge of three districts, the Vyshnevolotsk and the Vessiegonsk of the government of Tver, and the Borovichsk, government of Novgorod. The painted pottery, decorated with gold, of this manufactory is renowned; this concern became later the property of S. J. Maslennikov, and it was here that this intelligent leader organized the production of the first majolica wares in Russia. Majolica, mainly the English, made by Minton (H. Minton & Co., Stoke on Trent, Staffordshire), has been long an object of import into Russia, although to no great extent, together with the porcelain made on the continent, as also the English faience, the latter serving as a model; after long efforts and investigations the making of majolica was established at the manufactory of Maslennikov. A piece of land 20 versts distant from the factory where white clay was discovered resembling that of Borovichi in quality and appearance, was bought for the purpose; some other clays were brought from the government of Novgorod, as the Demiansk and the Tikhvinsk; and the Gloukhovsk clay of the Chernigov government was added for the manufacture of the finest sorts. Besides clay, other materials were used for the manufacture, such as sand, brought from a distance of 40 versts; feldspar and quartz brought from St. Petersburg; and stone found on the spot, namely, that forming the hills of the Vyshnevolotsk range.

The body of workmen chosen from those of the factory and from local potters included some tens of pupils, learning at the establishment itself practically the making of majolica; at the end of the year the more capable of them were selected. In like manner, painters and so-called sculptors were prepared from peasant youths under the direction of the chief foreman sculptor, who had served in the factory before it was owned by Maslennikov. Majolica wares were as usual made by different methods; the form was either given by turning on lathes, or by stamping, but forms of plaster of Paris were mainly used for that purpose. In the

hall assigned to that kind of work 40 machines were established. Enamels (coloured glazes) were prepared in a separate building under the direction of a special foreman Basil Iv. Zhoukov; the number of their shades was over 200.

The manufactory produced among other wares enamelled majolica, Dutch tiles, and painted plates for ikonostases and exterior facings. Instances of such goods are shewn by the church, built by the architect Lion on the estate of Mrs. Petrovo-Solovovo in the Kirsanovsk district, the facing of which is all made of majolica ornaments; the ikonostas in a church of the district of Kashira; the window arches in the chapel of St. Panteleïmon in Moscow, some parts of the Barbara chapel in Moscow, and others. The majolica manufactured by Maslennikov found ready markets toward the eighties in Moscow and St. Petersburg; in later years this special kind of work, remaining under the former management of S. J. Maslennikov, was joined to the vast manufactories of M. S. Kousnetsov. It should be mentioned that wares very much like majolica, made of light or reddish clays and enamelled with very bright coloured glazes, form a favourite branch of household industry in many localities; it often occurs that such wares, notwithstanding their cheapness, do not lack a certain amount of artistic taste, and serve ornamental purposes. Thus, in southern Russia, the peasants of Little Russia, of the Kharkov and Poltava governments, are manufacturing majolica uni-coloured and multi-coloured, for example, the peasant Padalka, Lebedinsk district, government of Kharkov, produces green majolica, and Roman Kouscha and Pavel Kalashnik produce majolica out of the clays of the Zenkovsk district of the government of Poltava.

The production of ornamental coloured tiles and mosaic ceramic plates for facing had in different times estimable representatives among the manufacturers, who learned the art at the Stroganovs drawing-school in Moscow, founded by V. J. Boutovsky, and having a special division for muffle painting on porcelain, faïence, and tiles, with a separate furnace situated in the Polytechnic Museum. Some of the leading manufacturers were engaged in the production; so for example, Gouszarev in Moscow was renowned for his terra-cotta wares made of red clay; A. J. Yagn, at whose factory in the village Voronki, in the Koseletsk district of the Chernigov government, peasant boys of 15 to 19 years did the work, and where the *mezhiborsk* kaolin of Kiev was used in the manufacture; the highest degree of artistic work was attained by Bonafede together with the academician Monighetti, and by the architect Kharlamov in St. Petersburg, as well as by some others. Nevertheless, the special development of the manufactory of S. J. Maslennikov, which arose by means of the gradual changes undergone by the simplest branches of the ceramic art, must be reckoned as one of the most important moments of the establishment of majolica manufacture in Russia; the further progress of this industry, seeing its character, depends only upon the measure of artistical taste and labour applied to it. This factory is situated in the village Chermiatka, 30 versts distant from the station Troïtsa of the Rybinsk-Bologoe Railway; the production of majolica forms now a part of the business of M. S. Kousnetsov, and this factory is owned by Dr Bieline, who has introduced another speciality, namely, the production of drain pipes.

Returning to the ceramic industry in the government of Tver, it should be mentioned that one of its localities, namely the Korchevsk district, nearest to the Moscow government, was one of the first centres of the manufacture of the highest

sorts of faïence in Russia. The first factory for the making of faïence plates was built in this district on the land owned by Golovachov; it had been established in 1809 by the apothecary Brunner, the potter Kobotsky, a turner of Gardener's manufactory, and by Reiner, a compounder of the mass at the same factory; the production went on for some years, when the works were sold to A. J. Auerbach of Lithuania. Auerbach moved shortly the plant to another place in the same district, namely, the village Kousnetsovo, where he developed its activity, which had a first rate importance in the history of the manufacture of Russian faïence. Auerbach was the first to produce faïence plates of a very high quality approaching that of the English makes, and he sold it at comparatively low prices: the plates made by Auerbach served as a model for other establishments, chiefly organized at the already existing porcelain factories. Persons interested in ceramics are aware that, although the making of porcelain has its specific difficulties, the producing of faïence is more difficult still, especially with regard to the compounding of the mass used in the highest sorts, for example, fine faïence, ironstone and earthenware. The manufacture of faïence appears to be more easy and simple than that of porcelain, because the latter has not so many steps in the process, which are noticeable in the production of faïence, under the name of which so many different sorts are collected, descending to the cheapest, namely, the semi-earthen wares. In fact, the difficulty experienced by the Russian factories, especially by those newly established, in imitating the best sorts of English faïence, for the production of which England is of old famous, in as much as the continent is celebrated for the production of hard porcelain, illustrates the above statement.

One of the first followers of Auerbach in the making of faïence in Russia was A. Sokolov, who founded in 1827 a small factory in Vyshni-Volochek. The production of faïence plates was, in 1832, introduced at the very ancient porcelain factory of Gardener in Moscow, but the work produced there never reached a high degree of quality. Some other factories existed for a short time; for example, the factory of Poskochin near Shlüsselburg, in the government of St. Petersburg; that of Nemart in Louga; later, that of Günter near St. Petersburg; that of Lövstrem in Kögsholm, government of Viborg, afterwards owned by E. N. Artemiev; and some factories in the government of Volyn, justly renowned for their excellent Kaolin; some of these manufactories produced really excellent wares, which however did not become widely known. The general success of the large manufacture of faïence in Russia having regard to the quality of the wares produced, dates only from the beginning of the eighties. The faïence manufactory in the Korchevsk district of the government of Tver was some time ago bought by the celebrated manufacturer M. S. Kousnetsov, who owns it still.

During the seventies the production of faïence in Russia was reinforced by the establishment in Finland of a new manufactory; it was that of *Arabia*, founded in 1873 in Helsingfors by Rörstrand, whose workshops were regarded as classical models in Stockholm (Rörstrand's Aktiebolag, Stockholm). Later on, that manufactory went over to a Finnish Co. (Arabia Porslinsfabrik Aktiebolag). The wares of this factory, of a comparatively good quality and approaching the English makes more closely than the Russian wares of that time, were widely spread over all the Empire, and especially in Moscow, at the end of the seventies and the first half of the eighties.

The markets of the latter region were always ready to buy examples of good quality. The Finnish wares exerted a great influence upon the development of faïence, serving as models and stimulating the home competition, especially in the large manufactories, in which at that period the household industry had centred, and which until then were of the greatest importance to the local markets.

Because of the stringencies of the times, the large manufactories were forced to lower the prices of their wares, and therefore the medium and lower kinds of goods became, of course, predominant; nevertheless, all measures tending to further the improvement of the highest grades of faïence have been employed since the end of the eighties until now, and good results in this specialty have been attained; the best sorts of the Russian faïence, however, made now mainly at the factory in the government of Tver, are not to be compared in quality with those formerly produced. The successes attained in the manufacture of faïence are the latest in point of time which the Russian ceramics have attained in its different branches.

In the government of Novgorod fire clays are very abundant; among them there are kinds which would astonish an amateur by their extraordinary qualities and peculiarities: for example, the so-called *velgheysk* clay found near the rivulet Velgheya, a tributary of the river Msta; the *kovankinsk soukhar* and other so-called *soukhars* of the district of Borovichi, which form no paste with water; and also other varieties.

The *kovankinsk-soukhar*, found on the lands of Mr. Kovanko, contains 41.10 parts aluminium, 38.01 bound and 4.45 free silica, 0.24 lime, 0.09 magnesium, 1.81 peroxide of iron; its loss in firing is 13.97 per cent. These clays, studied and analyzed by Russian as well as foreign specialists, for example, C. Bishof, brought about long ago, on the one hand, as a predominant branch of the ceramical industry, the manufacture of fire bricks and hearthstones, together with a large trade in fire-clay products, and on the other hand, the production of the fireproof plates for household use, able to resist the most various changes of temperature on cast iron hearths; it is a kind of stone plate of very strong coloured faïence, or wedgewood. Moreover, other special branches of ceramics, not dependent on the profusion of the fire clays, have developed in this locality; for example, the making of terra-cotta wares and ornaments at the factory of Zaitsevsky in Borovichi, where stonewares are also produced, as also at the factory of Fok in the district of Tikhvin where this product is a specialty. However, in this locality the first place must be allotted to the production of fireproof building materials, and to the now greatly developed manufacture of water mains, a branch of industry in which the import, chiefly from Sweden, and to some extent, from England and Germany, has until now been very considerable.

The making of fire bricks dates from time immemorial in different localities abounding in deposits of fire clays, in the form of a household industry; in a like manner it has existed in the government of Novgorod, especially in the environs of Borovichi. As an evidence of the preference given in Russia to the English fire bricks, considerably less now than formerly, may be cited the fact that the peasants of the district of Borovichi long ago stamped on the bricks made by them a special mark consisting of a lion and unicorn, as an indispensable attribute of the genuine fireproof bricks. Until now the words «English» and «fireproof» are synonyms when

referring to the quality of bricks; therefore, «English bricks» mean «fireproof bricks» in Russia. Special efforts to further this branch of industry in Russia were made by N. P. Gorizontov and K. Z. Vachter in the district of Borovichi, near the deposits of which many factories are now grouped. The largest establishment of the persons mentioned above is owned by K. Z. Vachter, namely the Zhdansk factory in the village Zhdani, eight versts distant from Borovichi, founded in 1880 on lands leased from Anichkov; the landowner Anichkov was himself formerly engaged in furnishing *borovichsk* fire clay, some sorts of which are until now known under the name of *anichkovsk*, to the manufactories of St. Petersburg. During the first six years of the existence of the business a hard task was set before Mr. Vachter, namely, the competition with English bricks imported duty free; while the sale of the Russian makes, the chief markets being the manufactories of St. Petersburg, was greatly impeded by the cost of the transport thither; the freight for bricks from England, chiefly from New Castle, to St. Petersburg was on the average 6 shillings per ton; and the freight for bricks brought from Borovichi, notwithstanding the short distance. (a little over 300 versts), by water ways not very convenient, or by rail, amounted to 7 and 7½ kopecks per poud, which reckoned at the average par exchange is equal to 8.5 to 10 shillings per ton. A considerable impetus to the fire-brick industry in Russia was given in 1886 by the placing of a duty upon such wares, the tax being also somewhat raised by the tariff of 1891, namely, to 4 kopecks in gold per poud.

The production of fireproof wares at the manufactory of K. Z. Vachter had attained a great development about that time; and now it not only comprises the manufacture of all sorts of brick, but that of a series of special articles used at some of the factories, requiring a high temperature as well, for example: massive moulds and abutments used in the building of furnaces, gas retorts, grooved plates for the vaults in muffle furnaces, melting pots, and all kinds of wares known by the name of *shamotny*, that is, fireproof goods. Mr. Vachter, in addition to the above-mentioned factory in the village Zhdani, has recently built a large manufactory near the station of Borovichi. The yearly output of fire brick at these two manufactories amounts now to 5 million pieces, while in 1888 the output was only half that amount. This production of course, as compared to that of the manufactories exporting their goods over all Europe, as for instance, the factories of the Hoganas Co. in Sweden, or that of Glenboig in Great Britain, the yearly production of the first ranging from 40 to 50, and that of the second from 70 to 80 million pieces, is only a beginning, made by a private person of great energy and ample means. However, this splendid initiative will undoubtedly serve as a strong basis for the further development of the manufacture of fire bricks in Russia.

The making of drain pipes and of stoneware has greatly developed of late at the same manufactory, owing to the excellent quality of the clays and to the rich supply of technical means furnished in both of these productions. Thus, there are 3 rolling and 3 cylinder presses for the making of drain pipes of the clay mass, which undergoes a series of various processes, such as rolling, grinding, frequent running through kneading machines, and receives as a necessary compound a certain quantity of finely ground fire brick (*shamot*) prepared in special grinding apparatus. For fuel, wood dried very thoroughly in a special wood kiln is used; there are four such furnaces at the manufactory with a general surface of fire grates of

16 metres. The equipment of the manufactory at the present time enables it to produce daily from 400 to 500 pipes, one arshine long, as drain pipes are generally made at Russian factories, and of the usual diameter of 6 to 9 inches; thus, the average production amounts to 120,000 pipes per year. Pipes of small diameters, beginning at 2 inches, are also made, but for them hand presses are used; large pipes are also made, 12 and 18 inches in diameter, and when specially ordered, of 24 inches. The pipes, 6 to 9 inches in diameter, cost at the manufactory itself from 39 to 40 kopecks per pound; brought to St. Petersburg the cost to the manufacturer is 64 to 66 kopecks per pound (one sagene of drain pipes of 6 inches in diameter weighs 3 pounds, and 5 pounds, if the diameter be 9 inches).

To give a better idea of the development of the manufacture of drain pipes in Russia other makes of the locality besides those of K. L. Vachter should be considered, for example: the factory of the engineers, Koliankovsky Brothers, under the title *Nor*, at Borovichi, which was founded a little later than that of Vachter, and is specially engaged in the making of drain pipes; at the present time the quantity produced exceeds that of the factory of Vachter by one and a half times; the Russo-American Co., for the making of ceramics, under the title *Nadezhda*, recently established and having as yet but an inconsiderable production of pipes, deserves mention, as well as the Warsaw factory, near the station Praga of the Warsaw-Terespol Line, owned by Grantsov, under the title *Kawczyn* (cegielnia Kawczyn), which produces ordinary bricks of various forms, as also fire bricks, and drain pipes 2 feet in length and from 4 to 12 inches in diameter; these pipes were used at the recent canalization of Warsaw, together with the imported Silesian pipes; the factory of Ovannesianz, already mentioned, near Moscow, at the station Vassilievo of the Nizhni-Novgorod Railway, is important, producing drain pipes of the *gzhelsk* clay, as well as wares of fire clay, such as arches, plates, pipes for gas ovens and steam boilers, fire bricks and pipes for canalization from 4 to 12 inches in diameter; the factory of Baron Bergenheim in Kharkov, founded some six years ago, and the small factory at Ekaterinodar in the Koubansk oblast belonging to the town, and that of the Princess Droutski-Sokolnitski near the station Ostrovets, government of Radom, also deserve notice. All these manufactories produced strong baked trench pipes approximately in the following quantity: in 1892 the manufactory of Vachter, to the sum of 70,000 roubles; the *Nor*, 100,000 roubles; the Warsaw, to 50,000 roubles; that of Bergenheim, to 50,000 roubles; all the others combined, to the sum of 70,000 roubles. Thus, the total production of drain pipes amounts to the sum of about 350,000 roubles; if the drain pipes of all diameters be reckoned at an average price of 60 kopecks per pound, then the production may be estimated at 500,000 pounds, sufficient to lay a yearly drain of 250 versts, if the weight of a sagene of pipes be reckoned on the average at 4 pounds. The import of drain pipes has decreased somewhat of late years; during the year 1891 to 1892, it amounted to 200,000 pounds, which, being reckoned by the same scale of weight, would make it possible to lay an additional drain of 100 versts in length.

As to fire bricks, the demands of the manufacturing industry in Russia, especially of the metallurgical works, are supplied to a considerable extent by home production. This material is prepared from local clays to a large extent by the very manufactories which require it. Recently some of the metallurgical factories began to produce

by their own means the so-called *dinas*, a special kind of quartzite or sandstone fire brick, until then reckoned as the special attribute of some metallurgical works. The production of fire bricks as an article of trade, for the use of the factories and for the aims of architecture, for the building of stoves for example, is as yet but feebly developed, and in very few special centres, the yearly output of which can be fixed approximately at 15 million pieces. The official statistics of the manufacture of bricks do not separate this amount from the general total of bricks, which for all Russia and Siberia in 1892, was reckoned at about 850 million pieces; the largest quantity was furnished by the Moscow government, namely about 140 million pieces, by the St. Petersburg government 73 million, by the government of Kharkov 45 million, by the governments of Kiev and Ekaterinoslav 35 million each, and by the Tauride government and the Don district 26 million each; the governments of Poland gave a general output of 142 million, those of the Caucasus 55 million, Turkestan 6,400,000, and Siberia, according to the published data, only 5 million pieces. The local production of bricks at the metallurgical works for their own use is not included in this number. Some of the smaller and temporary establishments also escape registering.

The figures showing the production of ordinary bricks are of course very small in comparison with those giving the production of the United States of America, and with those of the more prominent manufacturing countries of the Continent. As to the special demands for fire brick, as a ready article of trade, it may be stated for example that the demand of St. Petersburg alone ranges from 8 to 9 million pieces annually; the yearly demands of Moscow and other chief manufacturing towns can be fixed at 16 to 20 million pieces; thus the annual requirements of fire brick, partly satisfied by the home production and partly by imported goods, may be given at 25 to 27 million pieces.

The import of fire brick chiefly from the manufactories of Great Britain, Germany and Sweden, has averaged of late years from 10 to 12 million pieces yearly. Thus, between 1886 and 1890, 10 to 12 million pieces were imported annually; in 1891 the figure was 8,500,000 pieces and in 1892 it exceeded 12 million pieces.

To conclude this review of the historical development of the manufacture of fire bricks and drain pipes, as a specialty in the district of Borovichi the production of stonewares for chemical use, the material of which is very much like the impervious pipes hard baked, should be mentioned. The production of this class of wares for the last two years has developed at the above mentioned factory of K. Z. Vachter, which has been greatly enlarged by buildings especially adapted to the purpose, and which now supplies the chemical works of the regions of St. Petersburg and Moscow with apparatus and appliances, the demands for which have also greatly increased of late, owing to the increased activity of the chemical factories. Bomboloes of all the usual dimensions, pipes with thin sides and vases for special use, such as closed mixture vases for the nitrogenizing process used in the production of smokeless powder, having a diameter of 2.5 arshines, earthen bottles for the keeping and shipment of acids, small jugs and the like, are made at Vachter's factory, of a quality which is in no way inferior to that of the wares produced in the centres of ceramic industry in Austria and Germany, which during the last ten years have furnished these goods to the Russian chemical factories including even those in the Ural, al-

though some 2,500 to 3,000 versts distant from the nearest foreign centres of ceramic manufacture, for example, from Aussig in Austria, Charlottenburg near Berlin, or Kraushwitz near Muskan in Prussia.

Considering eastern Russia with regard to the ceramic industry, it should be mentioned that in the governments of Viatka and Perm some of the districts have always been looked upon as places where ceramics were greatly spread as a household industry, for example, the Shadrinsk district of the government of Perm. In the twenties of this century a porcelain factory was established near Shadrinsk by Fetissoy Brothers. The plates produced at these works were not of the first quality, and were even classed as second rate at the first Russian Manufacturing Exhibition in St. Petersburg in 1828; but the works should, however, be mentioned as those which laid the foundation of the porcelain and faïence industry in the east of Russia. Later on, towards the sixties, other factories were established in the governments of Perm, Viatka and Orenburg, chiefly by immigrants from the Gzhel region, where the increasing cost of fuel began to tell against the entire manufacture of plates. The factory of Fetissoy Brothers prospered; it produced, of course, principally the more ordinary kind of wares, which supplanted at the local fair of Irbit the goods formerly brought from Gzhel. The factory at Shadrinsk no longer exists, but some fifteen years ago another factory for the making of faïence was established in the district, and has been owned until now by Smirnov Brothers. In the neighbouring government of Ufa a porcelain factory was established, already in 1864 in the town of Ufa. The official statistics, not counting the faïence manufactory, give the number of the different ceramic works in the Perm government as 14, including herein the establishments producing semi-earthen ware and tiles. This government is very rich in fire clays; for fuel, wood or coal is used, according to the locality. Nearly everywhere in the government of Viatka the simplest forms of ceramics are a part of household industry, but as yet no centralization of it in manufacturing establishments has been noticed. However, in the district of Elabouga a factory making stoneware for chemical purposes, the production of which is second to that of Vachter's in Borovichi, has been founded at the large chemical works of P. K. Oushkov, situated near Elabouga not far from the river Kama, a powerful tributary of the Volga; this factory supplies only its own needs. P. K. Oushkov has developed this auxiliary industry of ceramics at his natrium factory in all its details, including even the making of mounting accessories, such as polished cocks, pumps and serpentine for refrigerators; it is very probable that with the growth of its dimensions the local establishment will furnish its wares to the other Russian chemical works.

In the south of Russia, where the making of pottery is wide spread as a household industry among the peasants, in many localities, deposits of excellent kaolins are found among those of former clays. The beds and qualities of these kaolins as well as the general deposits of fire clays in Russia, are described in this year's mining report and in a former work of M. Miklashevsky: «Deposits of fire clays in Russia», St. Petersburg, 1881.

To the already known, many newly discovered deposits on different lands are always being added of late. The most renowned beds of kaolins are in the southern region: those of the governments of Kherson, Ekaterinoslav, Chernigov and Kiev; more to the west, those of the government of Voïyn; more to the east, those

of the government of Orenburg; toward the north, the white clays of the government of Tula, namely, those found in the Yassensk clay pits, and those of the Dankovsk district of the Riazan government, are the most renowned, used chiefly in the making of fire bricks. The deposits near Gloukhov, government of Chernigov, were first known; they have until now a great importance for the Russian porcelain manufactories, because it is from here that they get the supply of the very fatty china clay to which they are accustomed, and even find necessary to add in small quantities of 5 to 10 per cent to the porcelain mass. The best sort of such kaolin is found at the village Poloshki, 8 versts distant from Gloukhov; at the present time over 200 to 300 thousands poud of this white clay is produced here yearly, the greatest part falling to the estate of Skoropadsky; the mining of the clay only takes place during the cold weather, namely, during the 2 or 3 winter months. The prices of such material are high; the Russian china factories pay for it more than a rouble per poud, freight included, that is, over 30 dollars per ton.

The clay found in the Gloukhovsk locality in its dry state presents pieces of considerable hardness and of a pure white; the upper layers are sometimes yellowish; when kneaded into paste with water, which is a rather hard process, it forms a very tender, immensely sticky mass, so that owing to the exuberance of its plasticity the highest sorts of it cannot be used for the shaping of wares without the addition of other more meagre clays. When English Cornwall kaolin is used in the production, most of the Russian manufactories find it necessary to add some of this fatty clay to the mass. Many small porcelain factories were established long ago in the Chernigov government near the deposits of kaolin; but they are no longer in existence. The largest and the most renowned of them was the factory of the proprietor, A. M. Miklashevsky, in the village Volokitino, district of Gloukhov, founded in 1839; this manufactory was able to compete in the quality of its wares with the best foreign makes. Besides perfect plates, objects of considerable dimensions were also made, evidences of which are to be found to this day in the village Volokitino, namely, all the *ikonostases*; the large lustre and the high candlesticks in its church have all been made at this factory. Notwithstanding its great technical success, this establishment closed its doors in the beginning of the sixties for some unknown reason.

In the government of Kiev among the deposits of fire clays, situated in the districts of Kiev, Vassilkov, Zvenigorod and Kanev, very delicate and pure kaolin, good not only for the making of faïence but for china as well, is to be found. One of the most renowned beds is the *mezhigorsk* near Kiev, at which at the end of the last century the first Crown porcelain factory was officially established. In 1798 an order was issued to install a Crown faïence factory within the walls of the abolished mezhigorsk monastery, and to assign 228 peasants to the works; later on, the number was doubled. At this manufactory 22 foremen, 80 pupils and 40 workmen were formerly engaged. The mezhigorsk Crown factory was during a long time the best representative of the production of earthenware in south-eastern Russia; the plates made there were famous in Russia, and until the thirties were almost the best, although the cost of the works and still more the expense of the freight to the principal markets, rendering the mezhigorsk wares dearer than the English makes, greatly impeded their sale and embarrassed the industry. Now that the development of the large manufactories in the Gzhel has reached such a

high degree of perfection, and has taken the first place in all Russia with regard to their trade returns, no such factories are to be found either in the government of Kiev, nor in all the other governments of the south, except those of Volyn and Kharkov, reckoning as the south of Russia all the territories lying to the south of 52° north latitude; but there are as before many small peasant workshops, and a certain number of larger manufactories for ordinary potter's work and for Dutch tiles. In the following nine governments: Voronezh, Ekaterinoslav, Kursk, Kharkov, Kherson, Taurida, Kiev, Chernigov, and in the district of the Don Cossacks, there are 54 special potteries, while in all European Russia there are 186. The greater part of these 54 southern manufactories of pottery and Dutch tiles, namely 23, are found in the government of Taurida.

Among the southern kaolins of the above-mentioned places the excellent Kherson kaolin is, besides the Gloukhovsk clay, at present much worked up. Its exploitation has been of late very considerably developed, chiefly in the strata of the Krivoy-Rog, where the celebrated iron ores are also found. It is used not only locally but is also exported. In the government of Kharkov the faïence manufactory of Mr Nikitin, about 50 versts from Kharkov, established in the year 1860, endeavoured to use, in the beginning of the 8th decade, the kaolins of the governments of Ekaterinoslav and Kherson in the manufacture of their wares. About that time the manufactory was transferred to M. S. Kusnetsov, was rebuilt by this enterprising gentleman, and has now become the chief centre of faïence manufactory for southern Russia.

Its importance to the Empire consists in its being the great centre for the employment of southern (Kherson) kaolins, and for its having become the medium for the use of home material in other manufactories. Of the three southwestern governments of Russia, Volynia, Podolia and Bessarabia, the kaolin strata of the first-mentioned are largely used, which are found in the circle of Novgrad-Volynsk and Zaslavel, for instance, near the villages Korets, Gorodnitsy and Baranovka. In these districts the first porcelain and faïence manufactories were established as early as the commencement of this century. They were conducted in those days by the representatives of the aristocracy.

The first manufactories of Korets faïence and porcelain, in the village of Korets, were those of the Countess Pototsky, of De Meseram in Baranovka, of the Prince Chartorizhsky in Gorodnitsy, which afterwards went into the hands of Mr. Rulikovsky, and which, in the aggregate of its wares, occupied the first place among the manufactories of the government of Volynia. At the present time these works remain, some in the same places as before, but in the hands of other proprietors; and some have been replaced by new establishments, for instance, in Baranovka the former manufactory, at present considerably improved, has passed into the hands of the Princess Kasimira Grokholsky; in Gorodnitsy there is a manufactory which has been transferred from Rudolf Bossy to B. I. Inghistov, and is now worked by Felix Susman.

The most important faïence and porcelain manufactory of this district, in importance and in the aggregate of its productions, belongs at present to the Princess Ludgard Yablonovsky, of the Novgrad-Volynsk district, village Kameny-Brod, although it is also worked by Isaac Susman. Besides these there are smaller previous-

ly existing works in the hands of I. I. Plachkovsky (formerly A. Peters), of the same district, in the village Dovbysh, and of Isaac Hershfeld in the district of Zhitomir, village Baramy. The total value of the production of all the present porcelain and faïence manufactories of the government of Volhynia reaches the sum of 175,000 roubles, whereof 125,000 roubles fall to the share of the chief manufactory of the Princess Yablonovsky.

Passing over into the western region of Russia, there are in the Polish governments, namely, Warsaw, Kalish and Radom, at the present time some faïence and porcelain manufactories which turn out a moderate amount of goods, the greater part of which fall to the share of German firms, for example, Teichfeld, Shreer and Engelman, Freidenreich, Rauch, in all at present 7 manufactories. The wares turned out of these manufactories consist particularly of faïence goods, to the amount of 375,000 roubles. In the neighbouring northern governments, Grodno, Vilno, Kovno, and Vitebsk, there are only some small manufactories for potter's work, 11 in all; in the first two governments there are a great many brick manufactories, which branch of the trade is more developed in the government of Grodno. In the same government there is a small porcelain and faïence manufactory belonging to Mrs. Fanshaw, district Belsk, estate Pakanevo, founded in the year 1879. In the Baltic governments, where there are some comparatively great centres of potter's work, particularly in Livonia, are found two porcelain and faïence manufactories which are distinguished not only for their home trade, but also for their exports into the neighbouring provinces of the northern region. The most important of these is in Riga, and belongs to M. S. Kusnetsov; the other lies in Müllgraben, a suburb of the town, and belongs to I. K. Essen and A. K. Khrapunov. The porcelain manufactories in Riga were established in the year 1843 by Sidor Terentjevich Kusnetsov, the father of the present proprietor. Before that, there was in this place a manufactory belonging to Kamarin, which was bought by M. S. Kusnetsov for a considerable sum, and afterwards closed. S. T. Kusnetsov bought a parcel of ground and built a new manufactory on it, which is working now. At present this factory, under the management of his heir, has become one of the most important centres of the great earthenware trade of Russia. The manufactory of Essen, one of the most active merchants of Riga, was established 1887, and makes very good porcelain. The annual value of its production is, however, equal only to one-fourth of the above-named manufactory.

For all Russia, as well as for the St. Petersburg market, the greatest portion of the faïence and porcelain goods are furnished by the manufactories of M. S. Kusnetsov. The porcelain and faïence manufactory of Ivan Emeljanovich Kusnetsov, which, as well as the above-named works of M. S. Kusnetsov, arose in Gzhel, and is situated in the government of Novgorod, near the station Volkhov of the St. Petersburg-Moscow Railway on the river Volkhov, on the very frontier of the government of St. Petersburg, is also of no small importance to the St. Petersburg trade.

The two celebrated porcelain manufactories of St. Petersburg are known from their great importance beyond the bounds of the country. The older one, the Imperial manufactory, in the artistic finish of its production is beyond all competition, and is known through all Europe. The other, the manufactory of the Kornilov Brothers, which must, from the merit of its productions, be placed, immediately after

the Imperial manufactory, at the head of all other Russian porcelain works, is known in America, where it has sent during the last few years its productions decorated in the Russian style. The Imperial porcelain manufactory, established in St. Petersburg in the middle of the last century, produces goods for the current necessities of the Imperial Court of a common kind, as well as for decoration, such as table and tea services, and a small number of ornamental and artistic productions.

From an artistic, as well as from a technical point of view this manufactory is at the present time a model, in spite of its very limited output, which places it in an unfavourable position. This is owing to its reorganization during its last period of management, which began in 1880. The high position in an artistic sense which it has long occupied, is well known to the amateurs of the ceramic art and to juries of the international exhibitions. (See, for instance, Exhibition of the Works of Industry of all Nations, 1851, London, Reports by the Juries, p. 542, Official descriptive Catalogue 318, p. 1376; *Relazione sulle industrie ceramica e vetraria all' esposizione universale de Vienna nell' anno 1873* del Giurato Richard cav. Giulio, Milano 1874, pag. 65; *Oesterreichischer Bericht über die Weltausstellung zu Paris im Jahre 1867*: IV, Glas- und Thonwaarenfabrication, Wien 1868, p. 217—218).

In their reports the foreign juries mention the attention and high personal interest which the Emperors, particularly Alexander II, took in the success and improvement of this branch of art in their countries*.

Of the artistic articles produced of late in the Imperial porcelain manufactory a classic service called the Raphael service, the painting of which has been taken from the *labbio* of the Vatican in all its details, attracts at the present time particular attention from the large number of the finest, most excellently painted vases.

Among its painters the manufactory numbers master artists, such as Krasovskiy, T. Tarachkov, and the sculptor A. K. Spiess, the manager of the artistic and technical division, L. L. Schaufelberger. Stencil work is totally excluded here, the more so as the productions of the manufactory do not come into the trade. Among the methods of technical decoration the coloured glaze produced at a high temperature, which has been lately worked out here by the chemists of the manufactory, the technical engineers K. J. Klever and J. K. Byk, is particularly remarkable. This glaze adheres to hard porcelain without any modification in its composition and gives an effect analogous to that on the present porcelain *nouvelle* of Sevres, or in Berlin Segger-Porcellan. Among the strains from the great heat there are most remarkably clean red colours, well known to be the most difficult, and which have been rediscovered only lately.

* ...Ma chi veramente anima e sostiene col suo valido patrocinio questa e le altre manifatture Imperiali è S. M. lo Czar che, per mostrare quanto degna stima faccia dell'industria e quanto ardentemente desideri di vederlo estendersi e progredire ne'suoi Stati, onora frequentemente della sua presenza le suaccennate manifatture, studia ed osserva ogni cosa, entra nei più minuti particolari e vuol rendersi conto di tutto. Il diploma d'onore conferito alle fabbriche Imperiali fu specialmente dedicato allo Czar come pegno di riconoscenza che l'industria da lui incoraggiata e protetta offre al degno successore di Pietro il Grando... (Richard cav. Giulio, l. c., p. 67).

The artistic and technical activity of the Imperial manufactory acquires a peculiar importance through its being an open school and direct nursery of special art and knowledge for the other porcelain manufactories of Russia. These latter may draw advantage from this school, in so far as it is possible to them, as well in the nature of their commercial activity as in technical organization. Notwithstanding the limited production of the Imperial manufactory the value of its articles annually produced amounts to 100,000 roubles; it occupies 175 workmen. The manufactory has in its large and well-furnished rooms, 4 blast furnaces, with a return air current. The mechanical driving power of the lathes is directly transmitted, at greater distances, by compressed air from compressors. There are two steam engines of 40 horse-power. Crushing mills acting after the runners, built of quartzite, and mechanical sieves work wet mills (Nassmühlen).

In the mould division there are mechanical lathes for round moulds, a compound set of rollers consisting of two roller systems with an intermediate lift by the elevator, an automatic sorter, and a steam injector for blowing out the dust. In the divisions for preparing the clay there are many cisterns, baking or drying. Meissen stoves, grinding apparatus (for the Gloukhovsky clay), 8 tubs in 3 stories for keeping and rotting the clay, Phor's mechanical roller lathes for kneading the ready mass before the working of it begins.

After the white hall, where the moulding of the articles is carried out, follows the workshop of the sculptor. In the adjoining wings are the rooms of the painters on porcelain. The great rooms of this division are, in their internal decoration, at the same time a sort of museum of the productions of painting on porcelain. Near these is the museum of the manufactory, which warehouses a remarkable collection of artistic porcelain articles of foreign schools, and the productions of the manufactory itself.

The porcelain works of the Kornilovs, in the artistic productions of which the talent of the school of the Imperial manufactory is expressed, was founded in St. Petersburg by the former dealer in porcelain articles, M. S. Kornilov, in the year 1835. Before this time there was in St. Petersburg, on the Viborg side, the porcelain manufactory of Batenin, founded after the war of 1812. This manufactory was known during the life of its proprietor, till the year 1835, by its middling and cheap sorts of wares. After the death of Batenin the works came under the management of the Court of Wards, and was closed a short time afterwards. Among the artistic productions specially belonging to the manufactory of Kornilov may be mentioned the remarkable articles in the old Russian style, scoops, cups, plates with Russian ornaments, plates with paintings from Russian life, some of them by the genial hand of Karasin, with typical scrolls and similar productions of a purely national character. These productions of the manufactory of the Kornilovs are known, as was mentioned, in America; from the year 1886 they have been imported into the United States for the well known firm of Tiffany & Co., Union Square, New York; this firm is for New York, the same as the Louvre for Paris, and has branches in London, 5 Argyll Place, W., and in Paris, Avenue de l'Opéra. They are remembered also by the visitors to the Paris Exposition of 1889, at which the greater part of the articles exhibited by the Kornilovs was bought by Americans.

The annual production of the manufactory amounts to 300,000 roubles and it

occupies nearly 300 workmen. The comparatively moderate prices favour a dissemination of the excellent articles among the public. In the economical organization of the manufactory the method of cleaning the fluid porcelain mass attracts attention. It is done by electro-magnets which draw out of the mass the magnetic iron particles. This method, carried out with the aid of a small dynamo engine and many electro-magnets with brush like poles through which is filtered the slowly flowing mass, was introduced into Russia by S. M. Kornilov, to whom also belongs the credit of the construction and application of electro-magnets to this purpose, which is more convenient than the Breget apparatus.

In the division for preparing the clay mass the factory works by means of dry crushers, in runners, and afterwards in Alsing drums. The Gloukhovsk clay, which is added to the mass, is ground and kneaded with water separately from the other integral parts. A membrane pump carries the fluid mass to the electro-magnetic apparatus, through which it flows to the filter presses; 7 furnaces of moderate diameter for burning the porcelain, work with wooden fuel; and there are 16 mufflers and 50 places for turners. The chromolithographic method in painting is used to a large extent. The chief sale of the articles of this manufactory is in St. Petersburg and Moscow.

The small porcelain manufactory of F. E. Emelianov in the Schlüsselburg district completes the number of the porcelain works in the St. Petersburg government, where besides this, as is usual near a capital, are found several small potteries producing particularly Dutch tiles, white and coloured pipes, and coloured plates.

Finally, in the north, in Finland, where there are altogether nearly 20 potteries producing articles of earthen ware and Dutch tiles for stoves, and where in the neighbourhood of great towns (on the sea shore or on the railway lines), there are some establishments for roofing tiles, two large faïence manufactories, the *Arabia* and that of W. Ansten, deserve particular mention. The latter is celebrated, among other things, for its excellent tiles for stoves and its ornamental works, while the manufactory *Arabia*, the importance of which for Russia was mentioned above, produces faïence of a high quality, and soft porcelain. The manufactory uses, as material for the faïence, imported English clay and black river flint, and applies very complete technical methods, particularly in the most important part of the work, namely, the preparation of the clay mass.

Besides the faïence wares the majolica of the same manufactory, attract attention by the cleanness of their painting and finish. The most characteristic goods are large decorative pieces, such as vases and plaques, with large white or cream drawings on a perfectly black glazed ground. The output of the manufactory *Arabia* amounts to 200,000 roubles, that of Ansten to 60,000 roubles.

Summing up what has been said in the foregoing account, especially with reference to the highest sorts of ceramic productions, porcelain and faïence, a more minute description of the present situation of these two branches in Russia may be given. The most considerable porcelain and faïence works, that is to say, those in which the extent of their production and sale, and the low wholesale prices are of great importance for the home trade, are the five great manufactories of M. S. Kousnetsov, as follows:

1. The works in Riga, consisting of 4 large divisions, each being an independent manufactory in separate buildings, and with a distinct management. It produces faïence of the highest quality, half-faïence, and porcelain of both high and common quality. The number of workmen engaged is 950, and the annual value of the production, 600,000 roubles. There are 18 furnaces and 5 steam engines, together of 154 horse power.

2. The manufactory in Tver (formerly Auerbach's, transferred 1871) under the firm of M. S. Kousnetsov & Co., which has preserved its former specialty of faïence production, and consists now of two divisions, one for high and the other for medium grades, with 1,220 workmen, and an annual production of 500,000 roubles; it has 12 furnaces, 4 steam engines of 88 horse power.

3. The oldest (1832) and largest manufactory in Dulevo, of the Pokrovsk district in the government of Vladimir, has for its specialty porcelain only. There are two divisions, for high and common porcelain. This manufactory is distinguished by furnaces of particularly large dimensions. Nearly all the furnaces have an inner diameter of 10 arshines (7.1 metres) and a height of 7 arshines (4.27 metres) to the arch. In 1884 there were in this manufactory 4 such furnaces; three of them, for common porcelain, and one for higher grades. At present there are 6 furnaces, 29 mufflers for burning in the colours, 220 potters lathes and 27 lathes for polishing. In the painting halls there are 466 places; there are two steam engines of a total 93 horse power. The fuel for the manufactory is peat; the light, electricity. The whole number of workmen is 1,400; their total annual earnings, 316,000 roubles. The annual production of the Dulevsk manufactory amounts to 600,000 roubles.

4. The manufactory in the government of Kharkov, district of Kharkov, volost Korotichansk, village Budy, remarkable for its using the kaolin of southern Russia, produces especially faïence ware. Reorganized by M. S. Kousnetsov in the year 1887, it has been considerably enlarged of late; it has 6 ovens and 3 steam engines of 50 horse power. The annual production amounts to 200,000 roubles, with 620 workmen.

5. The manufactory of the government of Moscow, formerly of Gardner, district Dmitrovsk, village Verbilky, which is held in history to be the first porcelain manufactory of Russia, founded nearly at the same time as the Imperial manufactory in St. Petersburg, has been more than a century in the hands of the Gardner firm, and produced in the first 75 years of its activity exclusively porcelain. It was the fifth porcelain manufactory in Europe in point of date, being outranked by those of Meissen, Vienna, Berlin and Munich. At the present time this manufactory has for the production of porcelain and faïence, 12 furnaces of moderate size, 38 mufflers and 1 steam engine of 30 horse power; it produces porcelain and faïence wares worth 200,000 roubles per year.

Consequently all five manufactories of M. S. Kousnetsov represent an annual production of 2,100,000 roubles, while the production of all the 47 porcelain and faïence manufactories of Russia together exceed 4 million roubles. Nearly the half of the production of the country is represented by these five large manufactories. Among the other 42 manufactories, the porcelain and faïence works of I. E. Kousnetsov at the station Volkhov, owing to its great output, should be mentioned first; its production amounts to 360,000 roubles, with 280 workmen (1890). Then come the Moscow manufactories, the representatives of the present Gzhelsk porcelain

industry in its former sites; two firms of Markov, G. A. and A. N., in the district of Bronnitsy, each with an annual production of 100,000 to 150,000 roubles, and with 320 to 380 workmen; and the firm J. G. Khrapunov, district Bogorodtsk, with a production of 170,000 roubles, and 285 workmen. Besides these large establishments, there are in the same districts 11 smaller works, with an annual production of 200,000 to 230,000 roubles in all. In the government of Vladimir there are two more old Gzhelsk firms, that of Sabanin and that of Zatsepin. The chief specialty of all the existing Gzhelsk manufactories is porcelain tea services.

The following statistical table gives a recapitulation per government, with the chief data of the production of the porcelain and faïence manufactories in 1890.

GOVERNMENTS.	Number of manufac- tories.	Value of pro- duction in roubles.	NUMBER OF WORKMEN.				TOTAL.	Monthly wages in roubles.
			Adults		Minors.		Work- men.	
			Men.	Wo- men.	Male.	Fe- male.		
Of European Russia . .	37	3,854,000	6,512	1,335	431	211	8,489	—
Vladimir	2	610,000	1,050	129	220	50	1,449	8—30
Volynia	5	178,000	264	30	10	—	304	10—24
Grodno	1	18,000	30	10	—	—	40	—
Kaluga	1	70,000	120	110	20	50	300	12—25
Livonia	2	740,000	895	230	61	35	1,221	13—50
Moscow	14	700,000	1,401	473	38	60	1,972	3—15
Novgorod	1	260,000	525	40	15	5	585	12—30
Perm.	1	3,000	20	—	—	—	20	5—12
St. Petersburg. . .	2	411,000	288	14	8	—	310	15—60
Tambov	4	26,000	112	5	5	5	127	4—20
Tver	1	500,000	993	173	42	6	1,214	8—10
Kharkov	2	206,000	575	93	12	—	680	8—25
Yaroslav	1	40,000	239	28	—	—	267	10—20
In Poland	7	375,000	583	242	4	6	835	—
Warsaw	4	276,000	320	160	—	—	480	6—60
Kalish	2	65,000	165	64	—	—	229	—
Radom	1	34,000	98	18	4	6	126	8—40
In Siberia	3	175,000	174	23	3	2	202	—
Yenissei	1	1,000	4	3	3	2	12	15—20
Irkutsk	2	174,000	170	20	—	—	190	15—75
Total . . .	47	4,404,000	7,269	1,600	438	219	9,526	—

Among the smaller firms beyond Moscow there are some which produce especially faïence; they make only table ware and some other small articles, for instance, vessels for apothecaries such as jars for salves and for preserving materials. Two small manufactories of the government of Tambov, and on the eastern side, one of porcelain in Ufa and one of faïence in Perm may be noticed. More important than these are those which are situated more westerly and centrally, for instance, the manufactory in the government of Kaluga which was always very popular among the people of an extensive area round about; the faïence manufactory in Pesochna, village Pesochensky, district Zhisdrensky, of General S. J. Maltsov, which manufactures from home clay, and was founded in 1853; and another faïence manufactory of the same proprietor in Lubokhna, in the same vicinity, in the district Briansk of the government of Oriol, founded in 1880. The faïence manufactory in Pesotchna, which attracts attention in the present case and which is almost lost sight of in the whole group of the manufactories of Maltsov, produces at the present time faïence ware of middle quality but at an exceedingly cheap price, and to the value of 70,000 roubles (the production of former years amounted to 100,000 roubles), with 300 workmen, 4 steam engines and 3 water wheels with a total of about 90 horse power. Referring to the above-mentioned porcelain and faïence manufactories of the government of Volynia, which use in their manufacture home kaolin, and which avail themselves of the rare advantage in Russia of having their own home spar and quartz, this general account of porcelain and faïence manufactories in Russia may be closed.

This preceding table shows that the total annual production of porcelain and faïence in Russia represents 4,404,000 roubles and that the main part of this production falls to the share of those governments where, as explained above, the former manufactories of Kousnetsov are situated, namely, in the governments of Vladimir, Livonia, and Tver; and then, in the governments of Moscow with its 14 large and small manufactories, and St. Petersburg with its two porcelain works.

As material for the Russian porcelain and faïence works, besides the home kaolins of different places, such as the Glonkhovsk, Khersonsk, Volynsk, Gzhelsk, and some other home faïence clays, the English imported kaolin is also used, the import of which into Russia is very considerable. The English china clay from Cornwall is imported of different sorts, beginning with the first quality which costs, for instance, in St. Petersburg 40 to 50 kopecks a poud, or about 15 dollars per metric ton, and going on to the fourth grade which costs 18 to 20 kopecks a poud, and is used, for instance, for telegraph insulators. Estimating with the foregoing that quantity of china clay which is used in paper manufactories, and which may be rated equal to that for the earthenware production, that is to say, about one-half of the whole demand for both purposes, the import of the china clay of Cornwall would amount to nearly 800,000 pouds a year, of which about 400,000 pouds are used in porcelain and faïence manufactories. Among the different sorts of china clay the blue is imported, which is sometimes used for faïence.

The feldspar and quartz for porcelain is brought from Finland and Norway, and from the government of Olonets. Besides this, as mentioned, the manufactories of the government of Volynia have their own feldspar; and near Ekaterinburg is found a quartz, and particularly spar, known under the name of Siberian. Quartz and spar are nearly of the same price, and cost on an average, quartz 18 to

25 kopecks, and spar 25 to 30 kopecks a poud. The English kaolin is received in a condition quite ready for use, namely, finely ground. This fact, together with the high price of the transport of the Russian kaolins to the large manufactories, is a great obstacle to the substitution of Russian kaolin for English, the home material not having been worked out till now regularly enough, and not undergoing such a preparation as in England owing to the method of working it.

The quartz and feldspar are always used after having been burned and assorted, and it should not be forgotten that their cost to the manufacturer, after these preparatory operations, is from 50 to 75 per cent above that of the raw material. From other sorts of the home kaolin one poud of a ready first-class porcelain mass, which has undergone the most complicated preparation, costs at the manufactory 1.50 roubles; of a medium quality 1.10 roubles to 80 kopecks; and for the lowest grades, for instance for isolators, 50 to 60 kopecks a poud.

Among the materials, besides the home and foreign clays used in faïence works are, sand, sometimes river flint, and limestone which is known in the manufactories of Moscow under the name *opok*. Such limestone is obtained, for instance, from Gzhel, where it is found together with clay, and from Myachkov, where there are large pits of the Myachkovsk limestone. Side by side with the management of preparing the mass goes on the moulding work. For this kind of work the fire clay of Novgorod (Borovichi), which is delivered in St. Petersburg at a price of from 15 to 18 kopecks a poud, is most used at present. Round about Moscow, mould clay from Gzhel is used; Volynia has its own material. The mass or the weight of the moulds, which are now thinner than they were formerly, stand to the enclosed weight of porcelain as 12 or 10 to 1. The moulds serve 3 or 4 times, that is to say, they hold out 3 to 4 burnings. The furnaces of the manufactories are mostly of satisfactory construction; until now wood has chiefly been used for fuel. In the first burning it is used in the form of rough sticks, and then in the form of chips split and dried in the furnaces themselves, being laid on shelves in the open fire place for that purpose. In some places, if the furnaces are of very large dimensions, the wood is not split, as for instance in Doulevo. Coals replace wood for burning porcelain and faïence only in Riga, Kharkov, and in the Polish governments. The total quantity of fuel used in the porcelain and faïence manufactories of Russia was estimated for the year 1890 as follows: wood, cubic sagues 42,200, or about 410,000 cubic metres, about 10,500,000 pouds, or about 174,000 metric tons; coal, 1,661,000 pouds, about 27.200 tons. To this amount must be added an inconsiderable quantity of peat, which is used by the manufactory of Kusnetsov in Doulevo at the same time with wood; about 5,000 cubic sagues with about 1,250 cubic sagues of wood, according to special data, and by some Moscow manufactories, 600 cubic sagues. If 1 part of coals be assumed equal to 2 parts of wood, and 1 part of peat equal to three-fourths parts of wood, and expressing the sum in coal, all these sorts of fuel would be equal to 7,288,000 pouds, or about 120,000 metric tons.

Payment is made to moulders by the piece, and to other workmen per month, as is shown in the last column of the foregoing statistical table in those limits which it generally reaches per month, according to the kind of work, the locality, and partly, to the kind of production. Among the workmen employed, as is seen from the table, there is a certain percentage of young people of both sexes under

age. These are young workmen which are used as carriers; they give to and take from the moulders and turners, or are engaged in making small pieces which are generally formed in gypsum, such as arms, and noses. Women's work is almost exclusively the cleaning of articles after they have been glazed and dried in the air.

The payment for work becomes in the Russian manufactories, as well as elsewhere, in the course of time dearer than at the beginning. The following example of lowest and highest monthly wages for the corresponding categories of workmen, especially in the porcelain production, where the difference between these categories is the most marked, shows this item of expense for two periods of time.

The medium payment per month in the best porcelain manufactories of Russia was as follows.

	In the forties.	Now.
A man of all work, with lodging found. . . .	7—8.5 rbls.	15—18 rbls.
Turners and common painters (the former are generally paid per piece)	15—20 rbls.	40—60 rbls.

On the average, according to the annual accounts, the expenses for the production in the porcelain manufactories which are occupied also with common painting, as nearly all of them are, are distributed in their different parts nearly in the following proportion.

E X P E N S E S.	Percentage value of the production.
Wages for all parts of production	50 per cent.
Fuel	20 » »
General expenses.	18 » »
Material for the clay mass	7 » »
Clay for the moulds	5 » »
Total. . . .	100 per cent.

The selling price of ready articles of the first sort from the best porcelain manufactories of Russia is for white articles without ornaments* as follows:

* Cheap printed ornaments are often for the manufactories a means of hiding deficiencies in the whiteness and cleanness of the surface of the article. Ornaments are therefore not always evidences of real value. On the other hand there are but few amateurs who prefer wares without any ornament, for instance, without painted brims.

White porcelain without ornaments costs on home markets per pound:

Plates 10 inches, 3 dozen plates per pound	9 roubles.
Service teapots and cups with saucers	13 »
Salad dishes, tureens and milk pots	15 »
Washbasins	20 »
Oval basins for fish.	25 »
Various thin articles, as ash pans and other small articles .	28 »

In fixing the average cost of porcelain in Russia excluding the prices of the last three categories of goods of no great importance, such large articles as washbasins being seldom demanded in porcelain, as less necessary articles of luxury, and therefore may be excluded from the account, it may be estimated that out of the first three columns, the average commercial cost of porcelain goods ranges from 12 to 12.50 roubles a pound. In like manner the average price for faïence of the first sort of Russian articles, may be placed at 4.50 to 5 roubles a pound; the price of the medium and lowest sorts, at 3 and 2.50 roubles, and the average price for all sorts may be taken as 4 roubles a pound.

The statistical data which, besides the two ceramic branches of the highest category, cover the more simple branches comprehended under the name of potters work and including the manufacture of Dutch tile, show that all the other ceramic manufactures of Russia, excluding bricks, amounted to 1,385,000 roubles in 1890. This sum is the gross of the output of about 200 pottery and tile factories with about 2,500 workmen, and does not include small home manufacture, this being an object of special statistics.

The above mentioned 200 pottery works have used the following amount of fuel: wood 15,370 cubic sagesnes, about 64,000 metric tons; coal, especially in the governments of Kharkov, Perm, Taurida and in Poland, about 202,000 pounds, 3,300 metric tons, which is equivalent to about 35,000 tons of coal.

The production of the brick manufactories for the year 1890 amounts to about 10 million roubles with about 30,000 workmen, and the following expense for fuel:

Wood, 111,750 cubic sagesnes, about.	465,000 metric tons.
Coal, 4,761,000 pounds	78,000 tons.
Turf, about 880,000 pounds	14,400 »
Naphtha residues, 80,030 pounds	1,360 »
Total coal equivalent	316,000 »

Naphtha residues for burning bricks are used in the Caucasus, and to some extent in the government of Saratov, one part of naphtha being considered equivalent to one and a half parts of coal.

Thus, the value of the home ceramic production is found for the year 1890 to give the following amounts:

Porcelain and faïence, together with earthenware and Dutch tiles	5,789,000 roubles.
Total including the above mentioned, together with the brick manufactures	15,800,000 roubles.

The import into Russia of foreign porcelain and faïence was always very considerable, notwithstanding that the duties fixed on these articles, 1 to 3.75 roubles a pound on faïence, and 5.30 to 21 roubles in gold per pound on the different grades of porcelain wares, have always sufficiently protected the home production. The development of the latter has been in general unusually steady and gradual, and particularly visible since 1878, just after the war with Turkey.

The amount of the annual import of porcelain and faïence in the last 20 years was as follows:

The value of porcelain and faïence imported across the European frontier:

1870	609,000	1881	937,000
1871	819,000	1882	1,140,000
1872	1,776,000	1883	874,000
1873	1,300,000	1884	779,000
1874	1,085,000	1885	812,000
1875	1,257,000	1886	803,000
1876	1,001,000	1887	530,000
1877	0,389,000	1888	591,000
1878	0,986,000	1889	739,000
1879	1,285,000	1890	650,000
1880	1,310,000	1891	752,000

In recent years the value of the imported faïence was nearly equal to that of the porcelain; for instance, in 1891, faïence was brought across the European frontier to the value of 383,000 roubles, and porcelain, 369,000 roubles. This proportion shows the predominance which faïence has over porcelain, as to the quantity imported. The average commercial value per pound of imported faïence is, according to the customhouse rating, for the three categories of articles, that is, articles without patterns, articles with patterns of one colour, and painted articles with patterns of various colours, 9 roubles, and 28 roubles respectively; whereas the prices of the corresponding three categories of porcelain are per pound 23 roubles, 45 roubles and 85 roubles, according to the valuation of the import of 1891.

As to quantity, there was imported in the year 1891, across the European frontier, of faïence about 32,000 pounds; and of porcelain, 9,400 pounds. In the year 1890 the import of faïence amounted to 30,000 pounds and of porcelain 7,540 pounds, with a value, for faïence, of 324,000 roubles, and for porcelain, of 318,000 roubles. Besides the quantities mentioned, faïence is brought across the Asiatic frontier, from about 10,000 to 15,000, and porcelain, 3,000 to 5,000 roubles.

The total value, therefore, of the faïence and porcelain imported equals about one-sixth of that of the home production, and the quantitative predominance which the faïence articles have in the import, corresponds to the comparatively weak state of that branch in Russia. At the same time the demand for faïence of good quality, arising out of the direct wants of the household, not only constantly exists, but increases faster than the home production. This predominance of faïence will always naturally arise from the fact that, in the household, the good durable faïence serves as well as porcelain, and is thereby in general the cheaper.

The best faïence until now for Russia has been the English, the German, and the

Dutch. Of the home production the faïence of Finland, which is used in the interior of Russia to the annual value of 60,000 to 65,000 roubles, is of great importance. Receiving this rather considerable quantity from Finland, Russia returns to the Grand Duchy its faïence of other sorts, and to some extent, its porcelain; for instance, Finland received in 1891 from the interior governments of Russia faïence to the value of 48,730 roubles, and porcelain nearly 5,700 roubles, a total of 54,430 roubles.

The faïence imported chiefly comes from Germany (Villeroy & Boch, and others) and amounts sometimes to one-third of the total import; England, the Netherlands, and in a less degree Austria, France and Denmark come next.

Simultaneously with the import exists a certain export of faïence and porcelain, which is directed across the European frontier, particularly into Roumania, Turkey, and to some extent to Germany; and of late years, of porcelain, to the United States of America. Porcelain is exported almost exclusively across the eastern and southern frontiers into Asia, and particularly into Persia. In 1891 there were exported into Europe and Asia faïence goods to the value of 29,000 roubles; porcelain into Europe and America for 98,000 roubles, and into Asia for 12,000 roubles; the total weight of porcelain was about 18,300 pounds. The whole export of porcelain and faïence amounted to 247,000 roubles.

Deducting this export from the total import, and adding the remainder to the sum of the home production, the amount of the home consumption in Russia of porcelain and faïence would be 5,000,000 roubles. The import into Russia of pottery, besides faïence and porcelain including drain pipes across all frontiers, strange to say, reaches in value the sum of the porcelain and faïence import together. The import of fire and common bricks, together with flooring tiles, common roof tiles and a small quantity of clay mass, amounted in 1890 to about 800,000, and in 1891 to about 860,000 roubles. Of these amounts fire brick and floor tiles form nearly three-fourths of the total.

Pottery articles of common and fire clay were imported as follows:

Years.	Pounds.	Sum.
1890	230,970	782,208 roubles.
1891	206,044	629,751 »

Such a considerable import proves that in Russia, among the products of the ceramic arts, there is a great deficiency of such articles as are most in demand for common household use. It is only of late, as may be seen from the foregoing account, that the foundations of a more complete development of the manufacture of articles of household use, and particularly of pipes and stoneware, have been laid, and that in the government of Novgorod. In any case it may be said that these foundations are sufficiently strong, and it may be hoped that in a short time the deficiencies in the home production will entirely disappear.

From the sum of the import and the home production the total commercial demand for ceramic articles of all three categories, namely, for faïence, porcelain and pottery, in Russia, amounts to not less than 7,000,000 roubles a year.



CHAPTER XIII.

Chemical Industry.

IN a statistical article the term «chemical industry» may either mean the exclusive production of acids, alkalis, salts like alum, blue copperas, chromates and pharmaceutical products like ethers and cosmetics; or else in a wider sense it may embrace many manufactures in which chemical actions and processes are taken advantage of, to obtain substances of the greatest variety, starting from dyes and ending with molasses, alcohol, illuminating gas, and the products of dry distillation. Although the manufacture of dyes is included in the present article, still «chemical industry» is understood in the first and more limited sense, not only because many of the manufactures founded upon chemical reactions are considered in the other sections of this work, but also chiefly because the manufacture of acids, alkalis and salts, like the alums and chromates, together with the preparation of dyes, forms quite a separate industry, whose products, although seldom met with in every day life, are indispensable to a multitude of industries and manufactures, and hence indirectly indicate the general state of the development of these industries. Moreover, in a number of chemical works the preparation of dyes is carried on simultaneously with the manufacture of acids and salts, and it is frequently impossible to separate the statistics of the one from those of the other.

When the industrial activity of the Russian nation was exclusively devoted to agriculture, then there were no real chemical manufactures in the Empire, and only a very few of the allied industries, such as distillery works, the preparation of tar and of certain dyes, for instance, madder, which on a small rural scale were carried on, not in works but only in the villages. To the present day the greater portion of the wood tar and resin is produced by industries having the same rural character. This is especially the case in the forests of northern Russia, which from ancient times have supplied many goods of this kind to the interior of Russia and abroad (Section VIII). But a true chemical industry, mainly treating substances of the mineral kingdom, only began to develop in Russia since the demand for those products arose with

the establishment of a manufacturing industry during the past century. Thus, the first chemical works arose as supplementary to other manufactories and works. This was particularly noticeable in Moscow, St. Petersburg, Ivanovo-Vosnessensk and Kazan.

CHEMICAL PRODUCTS.	IMPORT OF SODA ACROSS THE EURO- PEAN FRONTIER. 1.		TOTAL IMPORT ACROSS THE EURO- PEAN FRONTIER.		HOME PRODUCTION OF CHEMICAL PROD- UCTS AND DYES. 2.		Value of yearly con- sumption of chemical products and dyes.
	Carbon- ate.	Caustic.	Chemical products.	Average, and dyes.	Total.	Average.	
	Thousands of pounds.		In millions of paper roubles.				
1869	491	61	3.5	66 + dyes 14.3.	6.4	6.1	27.0
1870	718	192	5.0		6.1		
1871	665	286	6.2		6.0		
1872	684	258	6.7		6.2		
1873	820	348	11.5	12.0 + dyes 15 0.	6.0	5.4	22.4
1874	721	450	10.5		6.2		
1875	720	477	15.1		5.2		
1876	851	492	7.5		5.5		
1877	513	394	5.6	20.7 + dyes 18.4.	4.9	8.0	47.1
1878	895	705	21.4		6.1		
1879	1,080	620	23.1		6.0		
1880	1,049	672	19.3		7.3		
1881	1,053	676	18.4	13.2 + dyes 15.6. + dyes	8.7	12.4	41.2
1882	1,136	730	26.7		9.0		
1883	1,313	673	16.2		9.0		
1884	1,200	802	15.7		12.9		
1885	1,123	751	13.7	15.7 14.5 12.4	10.4		42.9
1886	1,081	790	12.8		10.5		
1887	724	860	12.1		12.8		
1888	642	913	11.7		15.3		
1889	705	883	12.6	15.7	14.6		42.9
1890	754	943	12.1	14.5	15.4		42.0
1891	443	764	11.1	12.4			

The Russian chemical industry was further animated by the erection of works in distant parts where it was difficult for foreign goods to penetrate, and where a

demand arose for considerable quantities of acids, particularly sulphuric, and for its salts, especially blue copperas and the alums, potassium cyanide et cetera, produced from local materials, for example, pyrites. Thus, for instance, Ushkov's works on the Kama near Elabouga were founded in the fifties for converting the Ural chrome iron ore into chromic salts, and these works have commenced using Ural copper pyrites in large quantities. So also several sulphuric acid works were started in Baku during the seventies and eighties, for the manufacture of acid from Sicilian and Caucasian sulphur, and for treating the products of the distillation of naphtha. But, as the customs tariff of that period allowed the majority of the foreign chemical products to pass into Russia either free of duty or with only very small dues, the majority of these goods, especially caustic and carbonate of soda, bleaching powder, pharmaceutical preparations, and dyes, were almost exclusively brought from abroad. This is proved by the fact that the import of chemical products increased more rapidly at this time than the internal production, which only satisfied a very small portion of the Russian demand.

EXPLANATORY NOTES TO THE FOREGOING TABLE.

1. Besides the import across the European frontier, chemical products are also imported to the Asiatic ports of the Black Sea, especially to Batoum and Poti, for supplying the wants of the Caucasian naphtha industry. For instance, the following amounts of caustic soda were imported through the Asiatic frontier:

1888;	1889;	1890;	1891;
216	153	134	142 thousand pouds.

Under the title of chemical products the customs tariff includes besides soda the import of Straasfurt salts, nitre, sulphur, antimony, arsenic, borax, cream of tartar, barium, strontium, aluminium, alums, ammoniacal and other salts and oxides, acetate of lime, bisulphide of carbon, various acids, copperas and green vitriol, and other chemical and pharmaceutical preparations not especially mentioned; but phosphorus, ether, soap, cosmetics, glycerine, matches, varnishes, et cetera, are not included. Among dyes and colouring matters the chief objects of import are: indigo, cochineal and other natural dyes, logwood, ultramarine, white lead and copper pigments, extracts of dyes and gall, alizarine and other artificial dyes, prepared dyes, ink and wax.

2. In the statistical reports the value of the yield of the chemical works is given together with the production of dyes, chiefly because many works produce both one and the other. But, as the extent and nature of the chemical industry cannot be accurately defined, there is often much that is contradictory and not clear in the official reports.

3. The chief cause of the decline in the value of the import during the seventies was the fall in the price of soda on the foreign markets; while the rapid rise of the import trade in 1878 is explained by the rise of all the customs duties; and the animated state of manufactures produced a rapid development of the home pro-

duction, and demand for chemical products required by other industries, while the home chemical works could not satisfy this increased demand owing to their previous feeble development, due to the fact that the duties upon chemical products in general were less protective than those on other goods.

4. The fall in the general value of the demands for chemical and colouring goods during the eighties was not due to a decrease in the demand, which on the contrary increased, but to the fall in price of many of the products and especially of aniline and artificial dyes.

It is evident from the data of the preceding table that the Russian chemical industry has from distant ages far from satisfied the demand, and although the home production of chemical products and dyes has increased, still it does not now exceed one-third of the demand. This is just the reverse from other manufactures, for example that of leather and paper, the home production of which greatly exceeds the import, from long ago. The cause of this must be looked for in the fact that chemical products, as auxiliary to other classes of industry, have long been subject to only very inconsiderable customs dues *, and that therefore their import was only natural. While manufactured goods were subject to not under 50 per cent customs dues, chemical products paid scarcely 6 per cent. Under these circumstances the only chemical works possible were those producing acids, especially sulphuric and nitric, and a few other products which either offered some difficulty in transport and storage, or, as with green vitriol, alum, et cetera, were so cheap that the cost of transport into the interior formed a great impediment. But, when the customs duties on chemical products were raised in the eighties, it became possible for the young Russian chemical industry to compete with the already established foreign export trade; the already existing Russian chemical works enlarged their operations and new and more perfected enterprises were started. Among the latter may be mentioned the Tentelevsk Chemical Works near St. Petersburg, which for instance treated *box-ite* and platinum ores, and carried on the manufacture of ultramarine and soda.

The fact that the raising of the customs duties during the eighties produced a marked although slow improvement in the home chemical industry, and also that many of the most important raw materials necessary for the full development of this industry, such as pyrites, sulphur salt, phosphorite, bone, et cetera, were known to exist in Russia, was taken into consideration in the revising of the customs tariff in 1891. The duties on foreign chemical goods, without being essentially revolutionized, were systematized, while in some few cases, for example, acetate of lime and caustic soda, the duty was raised. The fruits of such a procedure, which was only enforced in 1891, have already shown themselves in the increased produc-

* For example, in 1873, the import of sulphur amounted to 310,000 pounds; that of saltpetre from Chili, 304,000 pounds; of barium precipitate, 121,000 pounds; of salts of ammonium, 29,000 pounds; of sulphur-aluminous salt and alum, 111,000 pounds; of all kinds of soda, 1,168,000 pounds; of white lime, azotic and muriatic acids, 298,000 pounds; of acetic, oxalic and other acids, 18,000; the total amounting to 11,500,000 of roubles paper; the duties on these wares amounted to 68,000 roubles paper, or about 6 per cent of the value. In 1888 to 1890 the customs duties formed about 25 per cent of the value of the chemical imports, and the increase of the duties corresponded to the increase of the production of the Empire.

tion of soda, bleaching powder, and certain other substances which will be mentioned hereafter.

Thus the chemical industry of Russia can only be considered as being at the first stage of its growth, and its further progress can only be looked for in the further development of other kinds of industries offering a demand for chemical products. And as regards certain of them, when their exploitation attains its requisite and possible dimensions, then the natural conditions of Russia are such that it can produce an abundance of goods of the kind. Thus for instance, native hydrated sulphate of sodium, glauberite, or mirabilite occur in abundance in certain of the Central Asiatic lakes, in a dried up lake near the Zhandarmsk mountain near Tiflis, and is self-deposited in large and small lakes in the neighbourhood of Batalpashinsk not far from the Black Sea, to the north of the Caucasus, and in many other localities. Its exploitation has hardly been commenced, but when developed it could form a means for the manufacture of exceedingly cheap soda and caustic soda, as in Leblanc's process common salt has first to be converted into glauber salt, which requires the manufacture of sulphuric acid, and hence of hydrochloric acid, the demand for which is not sufficiently great.

This native glauber salt might also be a source of sulphur, which is now imported from Sicily. The vast masses of copper pyrites occurring in the Urals are now hardly touched, and are only converted into sulphuric acid on the spot at Povol'tsev's works, and on the Kama. The pyrites occurring at Borovichi, and in the Sub-Moscow and Donets coals, are only converted into sulphuric acid at small works, while they might serve as a most profitable source for the preparation of sulphuric acid and its by-products. The exploitation of the vast beds of native sulphur in Daghestan in the Caucasus, and in the Kara-Koumsk steppes in Transcaucasia, has hardly been started, although they are not inferior to the Sicilian deposits, and offer the important advantages of being near the surface and of being very rich. A similar untouched treasure-house is presented in the exceedingly thick beds of pure alumite or alum stone, discovered beyond the Caucasus at Zaglik in the government of Elisavetpol. Such stores of wealth, together with the inexhaustible deposits of phosphorites in the governments of Podolsk, Riazan and Smolensk, of manganese ore in the Caucasus, Dnieper and Ural, of chrome iron ore in the Ural, of nickel ore in the Ural, and of many other minerals, and also an abundance of every class of vegetable and animal raw stuffs suitable for chemical treatment, and for the preparation of most varied chemical products, all this wealth is still awaiting the hand of enterprising individuals to be converted into goods capable of export to other lands.

In a word, the natural conditions favourable to a vast and independent development of a large chemical industry in Russia, are so numerous that, when the home production attains its full growth, it will not only be able to satisfy the home demand in excess, but to attain such a degree of cheapness as would open the foreign markets to its goods. At the present time, however, it is only possible to bear witness to a feeble beginning in the growth of the Russian chemical industry, and for this purpose a short review of the production of certain of the most important chemical products will be given.

It is well known that the manufacture of sulphuric acid forms the basis of the

chemical industries. This acid is now produced in various parts of Russia, and its total production must now be counted as not under four million pounds; that is, of concentrated acid containing from 90 to 95 per cent of hydrate H_2SO_4 . The material employed for its manufacture is still mainly sulphur. The following figures give the amount of Sicilian lump sulphur imported:

	1888.	1889.	1890.	1891	
Across the European frontier.	1,114	993	871	588	thousand pounds.
» Asiatic »	249	173	254	241	» »
Total.	1,363	1,166	1,025	829	» »
Value.	1,086	865	988	654	thousand roubles.

The decrease of the import is mainly due to the fact that the Russian works, such as those of Oushkov, Hill and others, have followed the example of the Western European factories, and began manufacturing sulphuric acid from pyrites, which they either bring from abroad or extract in Russia.

The following figures give the amount of sulphur pyrites imported:

	1886.	1887.	1888.	1889.	1890.	1891.
Thousand pounds . .	225	186	275	289	141	744
» roubles . .	21	58	98	61	47	167

The home exploitation of native sulphur is still very small, altogether about ten thousand pounds were extracted in Daghestan, in the Caucasus, and in the Transcaspian provinces in 1889 and 1890. However, the home production of sulphur pyrites which is already considerable (in the district of Bogoslovsk alone up to 3,000,000 pounds of pyrites were extracted and roasted, mainly for the extraction of its copper, the manufacture of sulphuric acid being only lately added to this industry at the works of Polovtsev), still increases, all the more so as, according to the customs tariff of 1891. sulphur pyrites and sulphur are subject to an inconsiderable duty, and is more and more employed in the manufacture of sulphuric acid, and indirectly of copper, as in the Urals. In 1890 the following amounts of pyrites were supplied exclusively for the manufacture of sulphuric acid: at the Urals, 358 thousand pounds; at the Sub-Moscow coal mines, 391 thousand pounds, for the Sub-Moscow sulphuric acid works; at Borovichi, from the river Msta, for the local sulphuric acid works, about 100 thousand pounds; while altogether, over a million pounds were registered by the Mining Department. Now, in 1892 to 1893, the production of pyrites for the manufacture of sulphuric acid must be counted as nearly twice that amount.

The chief producers of sulphuric acid are those works which provide it to the Artillery Department for the preparation of smokeless powder or pyroxyline, and those which use it themselves for different purposes, and especially for the preparation of sulphate of sodium, soda, and sulphate of alumina. Such are, for instance, the above-named works of Oushkov and Co. on the Kama near Elabouga, and the Tentelevsk works near St. Petersburg. In the district of Moscow there are up to 20 chambers for the preparation of sulphuric acid, chiefly for supplying the demands of neighbouring works. At Baku there are three works preparing concentrated acid for pur-

irying the naphtha distillation products. In Poland. Kazan, Odessa, Kiev, and various other parts of Russia, as well as in St. Petersburg and Moscow, there are several sulphuric acid works, although the exact number of chambers is unknown, but it is not less than fifty; however, only a small number of these are of considerable dimensions, like those used at large chemical works. At many works the concentration of the acid is effected in platinum vessels, but the small works, and in some cases the larger, carry on the concentration in glass retorts. Many of the better works are furnished with the Gay-Lussac and Glover towers, so that in its qualitative aspect, the manufacture of sulphuric acid may already be considered as standing upon the basis of a technical and economical perfection, although there is still a lack of competition, which is seen from the fact that the price of acid concentrated to 93.5 per cent is rarely under 75 kopecks per pond. Nevertheless, the import of foreign sulphuric acid is small, for instance in 1890, not more than 51 thousand pounds of oil of vitriol, and under 11 thousand pounds of fuming acid, were imported.

The second most important branch of the chemical industry is the manufacture of caustic soda and carbonate of soda from common salt, by the Leblanc method or by the ammonia process. Now, both of these manufactures may be regarded as already established in Russia, although not long ago nearly all the soda required by the numerous industries using the salt, such as the naphtha industry and the soap manufacture, was imported. The import began to fall in the middle of the eighties, and was most marked in respect to carbonate of soda, which was produced in considerable quantities at Lubimov and Solvey's works situated at Beresniaki on the Kama, working with the ammonia process. But the import of caustic soda did not decrease. In 1890 over one million pounds, value at 2,333,333 million roubles, were imported. Nor did the import of bleaching powder and sulphate, 203,000 pounds in 1890, diminish, which clearly indicates the necessity of the creation of works for the production of soda by the Leblanc process, where caustic soda, bleaching powder, sulphate, and many other substances containing sodium and chlorine of common salt, can be simultaneously and conveniently produced. This evident want was satisfied by the works of Messrs. Oushkov and Co., also situated on the Kama. Thanks to the protective measures offered by the customs tariffs, and especially by that of 1891, the soda manufacture which forms the basis of the chemical industry is now firmly established, as is seen from the fact that since then Lubimov and Solvey have created a second large soda works for the manufacture of both carbonate and caustic soda in the Donetsk district near Lissichansk; and Messrs. Oushkov and Co. now turn out three hundred thousand pounds of caustic soda, and as much as two hundred and fifty thousand pounds of bleaching powder.

Besides the larger works, many of the smaller ones have started the manufacture of these most important products, so that in the near future the cessation of the foreign import, a revival of competition, a fall in prices, and even a foreign export may be looked for. It must, however, be acknowledged that the necessity of the manufacture of soda in Russia was long felt, but there were not the necessary economical conditions for it. It is true that in the seventies the salt destined for chemical treatment was freed from the excise of 30 kopecks to which it was then subject, but at that period, owing to the competition of the chemical works producing soda by the old Leblanc and the new ammonia processes, the price of soda and its products

were everywhere fluctuating; and there was such an over-production in Western Europe that the fall of prices was excessive, and the customs tariff only gave feeble help to the young Russian works in their struggle with the over-stocked European markets.

Soda was then only produced in small quantities in Russia, for example from the seaweed of the Caspian near Baku, or more frequently as a by-product in the manufacture of nitrate of potassium by the double decomposition of sodium nitrate and potash. Only in the depths of Siberia at Barnaul, Mr. M. B. Prang took advantage of the native sulphate of sodium, which he converted into soda to supply an inconsiderable local demand. When in 1880 the excise dues were completely removed from salt, and protective duties were placed upon soda, and its cognates, it became possible for the Russian soda to compete with the foreign, but as this required the circulation of large capital, without which it was impossible to hope for success, so this competition did not commence before the close of the eighties. And now the result of this competition is visible in advance, because the imports are distinctly decreasing; for example, that of soda has fallen from 739 thousand pounds in 1890 to 440 thousand pounds in 1891, and of caustic soda and potash, from 1,043 thousand pounds in 1890, to 916 thousand pounds in 1891; while in 1892, for which there are no data beyond November, the proportion of the import has further fallen by about 200 thousand pounds a year, so that it can be asserted with great probability that the import will entirely cease after the space of ten years, and that after fifteen years Russia will be in a position to export soda, owing to the advantageous conditions which it possesses for this industry, especially near the shores of the Black Sea, where the Batalpashinsk lakes present a direct source of sulphate of sodium, and where the Donets coal basin offers an association of coal pyrites, rock salt, limestone, fire clay and manganese ore, that is, of all the most important raw materials necessary for a vast development of the chemical industry, and where the abundance of grain and cheap labour, and a direct sea route, give the sure possibility of competing with other countries. When once the industry has taken root, it will develop itself so rapidly that it will overstock the home markets, and require an external trade, just as was the case with the naphtha industry.

Among the most important chemical products, the third place is necessarily occupied by nitric acid and its products, especially those used in the preparation of gunpowder, such as nitre and the nitro-compounds. The fundamental material of nitre, or nitrate of potassium, was for a long time, and is even now, extracted from the nitre heaps in the south and east of Russia where, owing to the great fertility of the soil, the manure has no economical significance for fertilizing the fields. Native nitre occurs in the Caucasus, in Daghestan, and in the Transcaspian provinces, but it is only exploited on a small scale for local wants, and thus the import of sodium nitre from Peru and Chili gives the cheapest material. Its import into Russia is limited to from two to three hundred thousand pounds annually. It is mainly used for the preparation of potash nitre for ordinary black powder, or of nitric acid for the preparation of nitro-compounds for making smokeless powder. These manufactures are not only carried on by the Government and private powder mills, of which there are three each, but also by chemical works, all the more so as nitric acid, or *aqua fortis*, is used for many technical purposes.

One chemical works, which makes a specialty of the manufacture of potassium nitre and its products, has according to official data a yearly turnover of 524,000 roubles, and employs 55 workmen. Formerly, when the preparation of gunpowder was chiefly carried on with local nitre, there were as many as fifty small nitre works, which since 1878 have gradually ceased working. The conversion of sodium nitre into potassium nitre is done either with the Stassfurt potassium salts, of which 95,000 pouds were imported in 1890, or with Russian potash, chiefly prepared from the ash of grasses in the east of Russia. In former times, even in the beginning of the seventies, there were as many as 195 potash works in Russia producing material to the value of one million roubles, and potash used to be exported from Russia in considerable quantities; for instance, in 1870, 597,000 pouds were exported. Since the appearance of the Stassfurt potassium salts, however, the export has greatly fallen; in 1890, 45,000 pouds, value 137,000 roubles, were exported, and not more than 60 works with 300 workmen are occupied in the production of potash. These works turn out from 200,000 to 250,000 roubles worth of potash.

This decrease in the production of potash may be partly ascribed to the fact that now soda is generally employed in the place of potash. Potassium salts are only still required for the preparation of potash alums and of bichromate of potassium, and potash is now partly prepared for this purpose in Russia. But the demand for potassium salts for the manufacture of gunpowder, and for other purposes, becomes smaller and smaller. Thus nitre does not enter at all into the composition of smokeless powder, and sulphate of alumina is more and more employed in the place of potash alum; while either chromic anhydrite itself, or the sodium salt, is used instead of the potassium salt.

The last of the above named chemical products was established in Russia comparatively earlier than many other of the branches of the chemical industry; and this was because they were required for manufactures whose development precedes that of the chemical industry. In the fifties, alum began to be prepared from clays, by first treating them with sulphuric acid and then with potash, while in the Caucasus alum was prepared from the local native alumite and other alum minerals. In the seventies, and especially in the eighties, several works in Russia followed the example of the Tentelevsk works in St. Petersburg, and began to prepare both alum and sulphate of alumina from boxite brought from abroad. Thus the above mentioned works of Messrs. Oushkov and Co. produce annually up to 200,000 pouds of sulphate of alumina, and 100,000 pouds of alum. Both these substances are also prepared at many other Russian works.

There are vast deposits of chrome iron ore in the Urals, and formerly considerable quantities of this ore used to be exported from Russia, but now the American ore has supplanted the Russian in the markets of Western Europe. At the present time about 200,000 pouds of chrome iron ore are annually extracted in the Urals, and, thanks to a timely protective customs tariff, the conversion of the ore into bichromate of potassium has been established in Russia since the beginning of the fifties at the above mentioned works of Oushkov and Co., and is now carried on at other works, for instance at those of Mrs. Polovtsev in the Urals, so that the home production, amounting to about 70,000 pouds per year, almost satisfies the demand. The same may also be said with respect to the alumina products. In 1890, 6,250

pounds of chromate and 128,000 pounds of alumina compounds were imported. The internal production exceeds the import by several times.

Among the other chemical products used in manufactures, bleaching powder is particularly important. It has now found a further application in the extraction of gold by chemical processes. Up to recent times it was brought into Russia from abroad to the amount of about 400,000 pounds a year. Now, when the duty upon it has also been rendered more protective (according to the customs tariff of 1868 the duty was 40 kopecks per pound, while now it is 70 kopecks gold), there are several works producing up to 300,000 pounds annually, and the import is likely to decrease, although in 1892 it remained almost the same, owing to the increased demand proceeding from the gold mines of the Urals, for the treatment of the gold «schlich» in the wet way, which considerably increases the yield of gold. The cost of the production of bleaching powder is naturally chiefly dependent upon the cheapness of hydrochloric acid, and so far this has not been the case in Russia, although it has long been so in Western Europe, owing to the fact that this acid appears there as a by-product in the manufacture of soda by the Leblanc process, while in Russia soda is produced in considerable quantities by the ammonia process; therefore hydrochloric acid is still comparatively dear, and the demand for it is considerable, especially for the preparation of chloride of zinc, which is used for soaking railway ties. As regards the manganese ore required for the preparation of chlorine and bleaching powder, Russia abounds in a mass of excellent deposits in the Urals, Caucasus, and in the neighbourhood of the rapids of the Dnieper, which in 1892 yielded as much as eight million pounds of ore.

Among other chemical products mention should be made of the manufacture of acetic, tartaric, and gallic acids, which is carried on, and is progressing at many works, as well as that of soluble glass, of green and blue vitriol, sulphate of zinc, sulphuric ether, ethereal fruit essences, and all kinds of pharmaceutical extracts and preparations, including iodoform and chloroform. The latter are prepared at Keller's pharmaceutical works at Moscow, and at Pehl's laboratory in St. Petersburg, and others. But it is impossible to discuss these substances in detail from the want of accurate statistical data, and from want of space. In any case their production is dependent upon the degree of the development of the above mentioned larger chemical industries, which are only in their infancy and are still far from satisfying the growing Russian demand, as is seen from the fundamental data of the table on page 226. It must be said, however, that the natural sources and means of Russia are often applied to manufactures of a chemical character when the necessary initiative appears in a given circle of inhabitants.

Thus, when there was a large demand for it, the manufacture of yellow prussiate or ferrocyanide of potassium was widely distributed among the peasants of central Russia, in over a hundred localities, because it did not require much outlay for its installation, and the raw materials, leather scraps, horn and hoof cuttings, and wood ash, were at hand. The growing of mint, cumin, and aniseed, which was first carried on for domestic purposes, formed under the initiative of the apothecaries the basis of a large rural industry for the preparation of the volatile oils contained in these herbs, so that now Russia exports considerable quantities of these ethereal oils, especially to Germany. Still more instructive is the example of the so-called

semen cinæ, collected from the artemisia of the Orenburg and Turkestan steppes, and which was for a long time exported for the preparation of the well-known medicine «santonine». When the local inhabitants knew the object of the export and the considerable mass of santonine sent to China and other parts of Asia, they began to prepare it themselves, and now together with the seed they export an excellent preparation of santonine. Thus, in 1890, 612 pounds, including 57 of specially refined, were exported, to the value of 90,000 roubles.

The preparation of phosphorus, the materials for which in the form of bones and phosphorites abound in many parts of Russia, had an almost similar origin in Russia, and especially in the government of Perm. During the sixties and seventies, from two to four thousand pounds of phosphorus, to the value of 100 to 120 thousand roubles, were annually imported into Russia for the manufacture of matches. Now the import trade has almost ceased; in 1890, 198 pounds, valued at 7,000 roubles, were imported. On the contrary, an export trade has begun, which in 1890 amounted to 156 pounds, to the value of 47,000 roubles; this is due to the erection of several large and small works for the preparation of phosphorus; and, as is known, this is a manufacture which is rather complicated and requires a good deal of experience. At the present time safety matches made of red phosphorus predominate in Russia. They are manufactured within the Empire, and have already found a market abroad. It should be mentioned here that the production of phosphorus in Russia was instigated in 1868 by a high protective duty of 10 roubles gold per pound. The customs tariff of 1891 raised this duty to 11 roubles, and, as has been already mentioned, protective duties have only been recently placed on the majority of other chemical products.

Russia is chiefly supplied with cosmetics by the works of Moscow, St. Petersburg, Warsaw, Odessa, and the districts lying around these cities. In 1890 there were altogether twenty-six such works, with a production of three million roubles worth of goods. The foreign import has long been limited to about 500,000 roubles, which shows that the home industry is sufficiently developed. And here it may be well to mention that the import of glycerine which has many other applications besides that of a cosmetic, has already given place to an export trade, and that it is prepared at several works in Russia, and notably at those of Krestovnikov in Kazan, where the purification of glycerine by distillation and systematical crystallization is carried on to such a degree that the product may be regarded as being as pure as possible, as the author found to be the case by investigations made by himself. It is not surprising that such a product should be exported, although there is a small import trade going on all the same.

Among the dyes and colouring matters it is necessary to distinguish the natural from the artificial, and the mineral from the organic. Of the natural organic dyes the most important are those which are produced in the tropics, because they are employed in large quantities for dyeing tissues. They form the object of a large import trade over all Europe, and Russia annually imports from 50,000 to 60,000 pounds of indigo, value six to seven million roubles; from 1,500,000 to 2,500,000 pounds of campeachy, sandal, log, and other woods, value 1,500,000 to 2,500,000 roubles; cashoo or catechu from 150,000 to 200,000 pounds, value 500,000 to 600,000 roubles; cochineal 3,000 to 5,000 pounds, value about 100,000 roubles; and various other dyes of

this class, such as turmeric, orsellic, luteolin, kermes seed et cetera, to the amount of 100,000 to 200,000 pounds, and valued at eight to ten million roubles.

In the forties and sixties the cultivation and export of madder roots from the Caucasus, and especially from Derbent, formed one of the Russian industries, but since the introduction of the artificial alizarine it has quite declined. Endeavours have been made to cultivate indigo wood, and other dye-producing plants in the warm Asiatic districts of Russia, but they were few and carried on with insufficient perseverance. This import trade gives occupation to many works for the preparation of the extracts of the wood dyes used in the arts.

As regards the artificial hydrocarbon dyes, and notably alizarine and those derived from coal tar, although they are used in considerable quantities in Russia as elsewhere, still their preparation has only been taken up as an experiment, because the insufficient development of the coal tar distillation and of the manufacture of many of the chemicals required, does not yet permit the young Russian industry to enter into competition with the German and French producers of these artificial pigments. Almost all that has been done in this direction consists in the working up of the nearly finished article, such as anthracene or alizarine brought from abroad, into the form in which it is used by the dyer, for example of alizarine into a paste containing 10 to 20 per cent. A more serious progress in this industry can only be looked for when the treatment of coal tar and naphtha refuse itself is better established in Russia. When the naphtha refuse is subjected to dry distillation for the preparation of lighting gas, a tar is obtained containing as large an amount of benzole and anthracene as coal tar, as is seen from the researches of Letnyi, Schmidt and others. But the treatment of this tar is not yet on a large scale, although the manufacture of lighting gas from the refuse is widely spread over Russia. The import of artificial coal tar pigments proceeds chiefly from Germany, and amounts yearly, as in 1890 and 1891, to 50,000 pounds, value 3,000,000 roubles. The greater part of this amount goes to the so-called finishing works, and therefore their turnover is estimated at about 2,500,000 million roubles, including sulpho-salts of the naphthalin series imported for the preparation of the azodyes, which are now much used in dyeing. Some of these factories in Moscow are branch establishments of German works. In Poland there is an independent works for the preparation of these pigments. Thus the manufacture of neither the hydrocarbon organic dyes, nor the natural or artificial dyes, is yet firmly established in Russia.

The manufacture of the mineral pigments is more developed, and in Russia they are now prepared both from natural coloured clays, and from other minerals such as chalk, baryta, hematite, lapis lazuli, et cetera, and especially from iron; for instance, colcothar from pyrites and vitriol; copper, for example, the green roofing paint from carbonate of copper, and from verdigris; lead, for instance, white lead and chrome yellow and zinc compounds, as zinc white. Ochres and other similar pigments and ferruginous clays are met with in abundance in many parts of Russia and they are now used at many works for the preparation of paints for walls, floors, and the like. The manufacture of white lead has made particular progress in the interior of Russia, where according to official data as much as 250,000 pounds to the value of 850,000 roubles are prepared annually. About 120,000 pounds of white lead are brought from abroad. Both the Russian and the imported white lead con-

tain a mixture of baryta. Although red lead is manufactured at several Russian works, it is now annually imported to the amount of about 100,000 pouds. Up to 20,000 pouds of copper pigments, including verdigris, are imported, and about 10,000 pouds manufactured in Russia. The same may be said of the blue mineral colours, such as ultramarine, Prussian blue, &c. They are already prepared in Russia, but their manufacture does not advance sufficiently fast, so that there is a simultaneous import trade in these materials. It is the same with the preparation of blacks, blacking, ink, and ground paints.

The commencement of these industries already exists in Russia, but the demand exceeds the production, and this is especially the case with the better sorts of pigments. The total value of the home production of mineral pigments, both natural and artificial, is twice that of the imported, so that here also the home manufacture has succeeded in making comparative progress with what it was not long ago; and the same may be said with respect to the manufacture of the organic hydrocarbon pigments, both natural and artificial. The manufacture of pigments is centred in the governments of Moscow and St. Petersburg, in Poland, and in the south and east of Russia.

The above data show that the home production of chemical and dye goods is still far from satisfying the growing demand, and that many branches require further development. However, the beginning of this development has already taken place; and as the customs tariff of 1891 has given a distinct although not excessive protection to these industries, as they have thereby made noticeable progress notwithstanding the short time since its improvement, it may be hoped that the home chemical and pigment manufactures will now move in the right direction, that is, that the foreign goods will gradually give way to the home products, as they have done in many other branches of industry, for instance, the manufactures of cotton goods and glass. And when with the help of protective duties the industry gains strength, then an export trade if not of all, at all events of many chemical products may be expected, just as it is with the manufactures which have long been the object of a protective system, for example, the naphtha industry (Chapter XV), the sugar industry (Chapter XVII), and even the india-rubber manufacture (Chapter VII). and some chemical goods, such as phosphorus (Chapter XIII).

THE MANUFACTURE OF ILLUMINATING GAS.

Owing to want of time certain of the articles upon the Russian technical industries were not prepared in time for the edition destined for the Columbian Exposition. In the case of one of these, gas manufacture, it was thought best to give a few general data extracted from Mr. S. J. Lamansky's article, because this manufacture is so intimately connected with the chemical industries.

The majority of Russian towns, mills, and works, are lighted by kerosene lamps; but in many cases gas and electricity are also used, although owing to the cheapness of kerosene they are not able to compete with the latter in respect to cost. In lighting with kerosene a well constructed lamp consumes not more than three and one-half grammes of oil per candle-power per hour; so that if the price per poud or 16,380

grammes be taken at one rouble, then 1,000 candles per hour will cost 22 kopecks. In the case of gas, 1,000 candles per hour require the consumption of not less than 330 cubic feet of gas, which even at the low price of 50 kopecks per thousand cubic feet costs at least twice as dear as kerosene. Moreover, in recent times the extension of gas illumination has been hindered by the introduction of electric lighting, which is now not only applied to many works and mills already furnished with motors, but at those having special, and notably, kerosene motors, which are very considerably used in Russia. Electric lighting has for a long time been used even in many mines, for instance, in the salt mines of the Donets district. The cheapness of kerosene, and the many advantages of electric light, have caused the manufacture of lighting gas to be but little extended in Russia, although there are excellent materials for its manufacture in the form of many of the Donets coals, and particularly of those to the south of Lissichansk, and of the Riazan bog-head, or the naphtha refuse (Chapter XV). Water gas and Dawson's gas have been tried in Russia but as yet they are scarcely used.

Thirty towns in Russia are lighted by gas; twenty-two of them produce about 2,000 million cubic feet (about 56 million cubic metres) of illuminating, and in the majority of cases, coal gas. Kiev is lighted by a mixture of wood and naphtha gas, Vilna by wood gas, Kazan and Yalta by naphtha gas. Besides these thirty towns, Mr. Reyn in a paper read before the St. Petersburg Technical Society enumerated 157 gas works adjoining various mills and 23 gas works of various railway stations. The majority of the small gas works extract their gas from naphtha refuse. This gas is known to be very dense owing to its containing numerous heavy hydrocarbons, and its manufacture in Russia is carried on very easily and simply. The largest gas works are in St. Petersburg, where about 20,000,000 cubic metres are consumed annually. Here, a certain portion of the gas is consumed in gas motors, which, however, are now being gradually replaced by kerosene motors.

CHAPTER XIV.

Manufacture of matches.

THE manufacture of matches having a head of smelted sulphur, *sernichki*, in Russia dates from the most ancient times. They were used in the kindling of the fires, for which purpose the match was touched to a burning coal taken from a heap of embers which had been covered in the *zagniotok*, (a cavity of the oven); they were also used when fire was struck by means of the steel, flint, and tinder. Owing to the fact that sulphur is easily ignitable, it was used for a long time in the making of phosphorous matches, their ends being first covered with sulphur and then with phosphorus. Therefore, matches are until now called *serenki* (made of sulphur) by the Russian peasants.

The manufacture of phosphorous matches had been established in Russia already before 1840, but its dimensions were for a long time very limited, partly because the bulk of the Russian people continued to use the flint and tinder for striking a light, and partly because the manufacture, as well as the use of phosphorous matches, was subject to very restraining regulations. Only since the demand for matches increased, and especially since 1859, when a law was issued allowing their manufacture without any special restraints to follow the regulations concerning the establishment of factories and free trade with the products, did the production begin to grow.

This increase, however, did not relate to the number of factories, which was subject to many fluctuations, as much as to the dimensions of the output. Thus, for the period from 1865 to 1887, the average number and the product of the match factories in European Russia, Poland excluded, were as follows:

Y E A R S.	AVERAGE NUMBER OF FACTORIES.	AVERAGE VALUE OF THE OUTPUT IN ROUBLES.
1865—1867	80	434,000
1868—1872	136	700,000
1873—1877	202	1,212,000
1878—1882	230	1,784,000
1883—1887	210	2,272,000

The above data show the great increase in the output of the Russian match factories. If the total product be compared with the number of factories, it will be seen that each factory had an average yearly output of 5,000 roubles, in the period 1865 to 1872; 6,000 roubles, in 1873 to 1877; 7,760 roubles, in 1878 to 1882; and 10,800 roubles, in 1883 to 1887. It should be mentioned, however, that only factories having a yearly output not under 1,000 roubles are included in these figures, while in addition to such establishments there was a great number of small works bearing the character of the Russian household industry, with a varying output of a few hundred roubles. According to the data collected in 1887 by the Ministry of Finance the number of establishments manufacturing matches amounted, for European Russia alone, to 337, while the data referring to the factories with a yearly output of not less than 1,000 roubles give their number as only 197. At first the manufacture of matches at the works and small household factories was of a primitive character. The greater part of such works exclusively used ordinary yellow or white phosphorus, and the production was under very poor sanitary conditions, in as much as the workmen were in no way protected from the phosphorous fumes.

With regard to technic the greatest improvement, made at the first stage of growth, namely, in the sixties, was the diminution in the percentage of phosphorus as a component part of the mass, called forth both by the expense and by the poisonous nature of the material. At first, 7 pounds of white phosphorous were used per 1,000 matches, and in the beginning of the sixties, at the best works, only 3 to 4 pounds were used per thousand. Later on, the so-called Swedish, or safety matches, lighted by rubbing against a surface covered with red or amorphous phosphorus, came into use. The first of the works producing such matches was established in Finland on the island Starsand near Björneborg, and in 1860 the first supply of such matches was brought from there to St. Petersburg. In the seventies some of the Russian factories began the work, but even in the eighties their number was not large, in fact it was limited to 6 or 7 factories.

To the improvements made in the production of matches of white phosphorus must be reckoned the means of protecting their heads from moisture by covering them with varnish and other cheaper compounds, introduced at some works already in the sixties, as well as the setting aside of sulphur, and the impregnation of the wood with stearine, paraffin, and the like, in order to avoid the development of caustic gases on ignition. For preventing the match from smouldering after the flame had been extinguished, the wood was impregnated with such compounds as would not lessen the inflammability, and at the same time render the match proof against smouldering, for instance, with borax, phosphureted salts, et cetera. The introduction of machinery for preparing the match sticks must be reckoned also among the technical improvements of the manufacture; however, many of the factories are still employing hand labour for the purpose, and prepare the sticks at the factories, or give the work out to special workmen.

As to the organization of the factories with regard to hygienic measures, improvements were a rare exception until lately, the greater part of the factories establishing only regularly working draft chimneys; therefore the workmen at the match factories using white phosphorus were always subjected to great risks. The disease engendered under such unhealthful conditions is a chronic or slow phosphorus pois-

oning, the first symptoms of which are loss of flesh, with a yellowish skin, followed by pains in the stomach, debility and trembling of the limbs, palpitation of the heart, and like affections; in some cases diseases of the breathing organs are noticed, but the worst consequences of phosphorus poisoning are inflammation of the lungs, and gangrene of the maxillary bones.

In view of the above mentioned unfavourable hygienic conditions in which the match factories are placed by the very nature of their method of manufacture, when in 1887 the question of the instalment of a tax upon matches arose, and a special conference at the Ministry of Finance for the deliberation of the proposition was organized, the conclusion was reached that such a tax was highly desirable, especially from the hygienic and sanitary points of view, as likely to bring about an improvement in the organization of the factories and in the conditions of the work in them. In order to further such improvements, and to prevent the opening of factories too small to be able to answer all the sanitary and hygienic requirements, the rule was laid down that the existing match factories should use band labels to the value of 1,500 roubles, and the newly established works, to the value of 3,000 roubles. Moreover the conditons were made obligatory to every factory, that it should have the following principal premises: 1. a separate storehouse¹ for the keeping of phosphorus, sulphur, Bertholet's salt, and paraffin; 2. a section for the preparation of the phosphureted mass, and the dipping therein of the match ends; 3. another house for the packing of matches and the putting of the band labels on the boxes; 4. a separate storehouse for the keeping of the packed but not yet labelled boxes.

When on January 4, 1888, the law was issued ordering an excise to be levied on matches, and was put into force from May 1, the production of matches entered upon a new period of existence; although, owing to the above mentioned exactions with regard to the organization of the factories, some of them closed their doors, the production, however, grew to be more regular, and the quality of the products, as well as the sanitary and hygienic conditions of the work, greatly improved. In 1887 there were in all 360 match factories; in 1888, after the instalment of the excise, their number decreased to 278.

The table on the following page shows in what regions the number of such factories has mostly decreased. From the same data it may be seen that the general decrease of the number of match factories in 1888 as compared to 1887 was about 23 per cent.

Of the 278 establishments making matches in 1888 the greater part, namely 233, or 80.2 per cent, were producing phosphorous matches, the number of those making them without phosphorus being only 17, or 6.1 per cent; 38 factories, or 13.7 per cent, making both kinds of matches. The total output of all the match manufactories amounted in 1888 to 59,355,325,000 pieces. This quantity comprised, however, only those produced after the instalment on May 1, 1888, of the excise; but when the total stock stored up in the several trade establishments was reckoned on June 11, 1888, the amount of such matches in the whole Empire was found to be 24,036,646,000 pieces.

Of the matches produced since May 1, at the 278 factories at work in 1888, the quantity of which is mentioned above, 77.5 per cent fell to simple phosphorous matches, and 22.5 per cent to non-phosphorous, the central manufacturing govern-

G O V E R N M E N T S.	NUMBER OF MATCH FACTORIES.		In 1888 less.
	In 1887.	In 1888.	
The northern (Archangel, Vologda, Novgorod, Olonets, Pskov)	26	21	5
The eastern (Viatka, Kazan, Perm, Samara, Ufa)	75	55	20
The central manufacturing (Vladimir, Kaluga, Kostroma, Nizhni-Novgorod, Smolensk, Tver, Yaroslav)	63	52	11
The central Chernozhiom (Kursk, Orel, Penza, Riazan, Saratov, Simbirsk, Tambov)	109	79	30
Little Russia (Poltava, Kharkov, Chernigov)	14	11	3
The Baltic (Courland, Livonia, Esthonia)	11	9	2
The north-western (Vilna, Vitebsk, Grodno, Kovno, Minsk, Moghilev)	25	17	8
The south-western (Volyn, Kiev, Podolsk)	3	2	1
Poland	12	11	1
Transcaucasia	1	—	1
Total	339	257	82

ments producing the greater part of the former, (13,725,360,000) and the northern governments, the greater part of the latter, (5,610,586,000). Phosphorus, being one of the principal materials used in the manufacture, is worked to a sufficient extent in Russia itself. During the period from 1889 to 1890 there were ten factories for the production of phosphorus, nearly all of them centred in the eastern and northern regions, one only being in the western part of Siberia, in Tumen; their total yield of phosphorus reached 11,386 pounds, including 10,740 pounds, 94.4 per cent. of white, and 646 pounds, 5.6 per cent, of red phosphorus.

The distribution of the product was as shown in the following table.

GOVERNMENTS OF :	NUMBER OF FACTORIES.	QUANTITY OF PHOSPHORUS PRODUCED.		
		White.	Red.	Total.
		P o u n d s.		
Vologda	1	697	4	701
Novgorod	1	140.6	—	140.6
Perm	6	9,808	642	10,450
Vladimir	1	4	—	4
Kaluga	1	91	—	91
Total	10	10,740.6	646	11,386.6

Thus, the government of Perm is the principal centre of the phosphorous works with the largest output of red and white phosphorus, their number being 6, with an average yield of 10,450 pounds, forming 91.8 per cent of the whole product of Russia.

Phosphorus is sold in Russia either by wholesale, or in apothecary shops by retail. The principal stores for phosphorus are in the governments of Moscow, Nizhni-Novgorod, Viatka, Perm, St. Petersburg, Livonia, Vilna, Kherson, Kharkov, Chernigov, and Warsaw. The prices for the material are not high, namely, from 28 to 41 roubles for white, and from 40 to 62 roubles for red phosphorus per pound. The quantity produced in Russia not only supplies the home requirements, but a considerable amount is exported. Thus, the export was as follows:

In 1885 . . .	237 pounds	In 1888 . . .	3,699 pounds
» 1886 . . .	1,021 »	» 1889 . . .	3,150 »
» 1887 . . .	1,958 »		

The import of phosphorus into Russia is subject to many fluctuations, but on the whole it is decreasing, as seen from the following figures:

In 1885 . . .	3,890 pounds	In 1888 . . .	985 pounds
» 1886 . . .	753 »	» 1889 . . .	189 »
» 1887 . . .	1,342 »		

The match sticks are either made at the factories themselves or given out to be worked by *koustars*, who very often make the packing boxes also. For this purpose aspen wood is chiefly employed, it being very porous, and unsuitable for more expensive uses. Lately some of the works situated in the ports prepare considerable quantities of sticks for export.

The temporary decrease in the manufacture of matches, due to the instalment in 1888 of the excise thereon, was followed by a new development of the industry. In 1889 the number of factories reached 312, and the average output increased also, which in 1888 owing to the closing of some of the works and the delay in the opening of those that survived, as well as to the large stock of matches on hand before the introduction of the excise, had somewhat decreased. However, in 1890 and 1891, the number of the factories again decreased, but the dimensions of the output grew considerably, especially the making of matches without phosphorus, for which special works were organized. The following data give an idea of the comparative number of match factories and their output for the years from 1888 to 1891.

YEARS.	NUMBER OF FACTORIES.				QUANTITY OF MATCHES PRODUCED IN THOUSANDS.		
	Phosphorous.	Non-phosphorous.	Both kinds.	Total.	Phosphorous.	Non-phosphorous.	Total.
1888. . .	223	17	38	278	45,985,711	13,369,614	59,355,325
1889. . .	240	20	52	312	111,719,366	27,984,361	139,703,727
1890. . .	200	20	70	290	108,258,303	34,590,970	142,849,273
1891. . .	189	25	57	271	106,902,912	37,844,413	144,747,325

These data show that since the instalment of the excise upon matches their production in Russia tends visibly to increase. The number of factories making phosphorous matches has decreased; those having a mixed product have fluctuated considerably in number, but those making safety matches have increased in number and in output, at the expense of those manufacturing simple phosphorous matches. Thus, in 1890 the output of safety matches in comparison to that of 1889 had increased 23.6 per cent; in 1891 as compared to 1890, 9.4 per cent; in the mean time the making of phosphorous matches had decreased in 1890, 3.1 per cent; and in 1891, 1.3 per cent. The average product of the factories grew accordingly; in 1889, it reached 447,700,000; in 1890, 492,500,000; and in 1891, 534,100,000 pieces.

The match factories were distributed in different regions for the last three years as follows:

G O V E R N M E N T S.	NUMBER OF FACTORIES.		
	In 1889.	In 1890.	In 1891.
Eastern	61	62	62
Central Chernoziom	86	71	61
Central manufacturing	59	53	52
Northern	24	24	21
North-western.	19	17	16
Little Russia	13	14	14
Poland	11	13	12
Baltic	10	11	9
St. Petersburg and Moscow	10	8	6
Western Siberia.	7	6	6
Eastern Siberia.	4	3	2
Southern	4	4	4
South-western.	3	3	4
Turkestan	1	1	1
Transcaucasia.	—	—	1
Total . . .	312	290	271

From these figures it may be seen that the greatest number of the factories in 1891 were in the eastern region, namely 22.9 per cent, while in the two preceding years the first place was held by the central Chernoziom region; in 1890, 24.5 per cent, in 1889, 27.5 per cent, which is now second, 22.5 per cent. Other regions come in successive order as follows: central manufacturing, 19.2 per cent;

northern, 7.7 per cent; north-western, 5.9 per cent; Little Russia, 5.2 per cent; Poland, 4.4 per cent, et cetera. In 1891 one factory was established in Transcaucasia, where until then no such works had existed.

The distribution of the match factories of different categories in 1891 in the various regions is seen from the following figures.

G O V E R N M E N T S.	N U M B E R O F F A C T O R I E S.			
	Phosphor- ous.	Non- phosphor- ous.	Both kinds.	Total.
Eastern	44	1	17	62
Central Chernoziom	55	1	5	61
Central manufacturing	41	—	11	52
Northern	11	6	4	21
North-western.	10	1	5	16
Little Russia	9	3	2	14
Poland	5	1	6	12
Baltic	2	5	2	9
St. Petersburg and Moscow	3	2	1	6
Western Siberia	4	—	2	6
Southern	2	1	1	4
Eastern Siberia.	1	1	—	2
South-western.	2	2	—	4
Turkestan	—	—	—	1
Transcaucasia.	—	1	—	1
Total . . .	189	25	57	271

It follows, therefore, that in 1891 the number of the factories producing simple matches formed 69.8 per cent; safety matches, 9.2 per cent; and both kinds, 21 per cent; while the former method included in 1890, 69 per cent, and in 1889, 77 per cent; the second, 6.9 per cent, in 1890, and 5.4 per cent, in 1889; and the third, 24.1 per cent in 1890, and 17.6 per cent in 1889.

The greatest part of the works making safety matches falls to the northern governments, then follow the Baltic, Little Russia, St. Petersburg and Moscow, south-western and others. The factories having a mixed production are mostly spread in the eastern region, after which come the central manufacturing, Poland, central Chernoziom, north-western, northern and others. The successive order of the regions according to the amount of their output may be seen from the following table.

GOVERNMENTS.	THE QUANTITY OF PHOSPHORUS USED AND THAT OF MATCHES IN THOUSANDS.					
	1889.		1890.		1891.	
	Quantity of phos- phorus in pounds.	Number of matches.	Quantity of phos- phorus in pounds.	Number of matches.	Quantity of phos- phorus in pounds.	Number of matches.
Central manufactur- ing.	2,262.5	32,745,123	2,327.7	31,357,844	2,111.9	30,020,817
Eastern.	1,471	20,226,701	1,470.6	25,305,062	1,732.1	26,139,679
Central Chernoziom.	1,194.7	20,419,084	1,485	20,343,306	1,223.4	21,460,593
Northern	631.4	18,784,487	454.3	19,335,824	370.1	18,344,398
Little Russia . . .	1,165.7	20,698,706	875.6	19,657,503	813.3	18,314,436
North-western . . .	284	8,551,542	420.5	8,812,066	420.1	9,209,932
Baltic	105	4,771,830	118.8	5,219,244	351	5,443,068
Poland	174.1	4,127,567	157.2	4,536,845	178.3	4,536,426
Western-Siberia . .	384.2	2,918,888	137.3	2,765,027	249	3,651,543
Southern	243.1	3,628,882	192.5	3,258,905	176.1	3,002,876
St. Petersburg and Moscow.	90.8	1,969,809	63.4	1,543,750	57.8	2,452,830
South-western . . .	21.2	474,525	20	208,218	26.5	857,296
Turkestan.	28.3	141,615	51.6	223,857	40.7	317,871
Eastern-Siberia . .	49.2	514,963	—	231,822	12.8	312,624
Transcaucasia. . .	—	—	—	—	18	123,477
Total . .	8,125.2	139,703,728	7,774.5	142,849,273	7,781.6	144,747,325

These figures show that the production has lately centred chiefly in the different regions as follows: central manufacturing, 20.8 per cent of the total output of the Empire; eastern, 18.4 per cent; central Chernoziom, 14.8 per cent; northern, 12.7 per cent; and Little Russia, 12.6; all the other regions together, 20.7 per cent.

According to the average amount of the output, which in 1891 reached 534,123 thousand pieces in the Empire, the order for the different regions was as follows, the factories of Little Russia having the largest production: in 1889, 1,592,208,000; in 1890, 1,404,108,000; and in 1891, 1,308,174,000 pieces; then followed, in 1889 and 1890, those of the southern region, 970,220,000 and 814,726,000 pieces; and in 1891, those of the northern region, 873,543,000; in 1889 and 1890, 782,686,000 and 805,659,000; then again in 1891, those of the southern region, 750,719,000 and so on. The smallest output fell in 1889 to the factories of eastern Siberia, 128,741,000; in 1890 to those of the south-western region, 69,406,000; and in 1891 to that situated in Transcaucasia, 123,477,000.

With regard to the kind of matches made (phosphorous and safety matches) the first place in the making of simple phosphorous matches must be allotted for all

three succeeding years to the central manufacturing region (in 1889, 30,440,339 thousand; in 1890, 27,614,887 thousand; in 1891, 26,907,125 thousand): next came the regions, eastern, central Chernoziom. and Little Russia (from 24,738,870 to 15,628,365 thousand); the north-western (5,067,323 to 6,596,620 thousand), et cetera. The smallest production was in 1889 in Turkestan (130,813 thousand); and in 1890 and 1891, in the south-western region (118,009 to 38,588 thousand). Safety matches were chiefly produced in the northern region (1889, 14,731,463 thousand; in 1890, 15,413,126 thousand, and in 1891, 14,461,296 thousand); the Baltic (in 1889, 3,578,701 thousand; in 1890, 4,334,518 thousand; in 1891, 4,726,745 thousand); the north-western and central manufacturing (from 1,954,922 to 4,142,609 thousand), et cetera. The least output was in Turkestan (in 1890, 4,265,000; in 1891, 10,226,000; and in 1889, 10,801,000).

Besides simple phosphorous and safety (non-phosphorous) matches. Bengalese matches have been lately manufactured in Russia, their output being, however, very insignificant. According to the data of 1891, 13 factories were engaged in this branch of the industry, producing on the average 1,746,000 boxes of matches containing each from 15 to 75 pieces. As the making of this kind of matches proved to be injurious, a law was issued November 16, 1892, forbidding its further manufacture.

According to the regulations of January 4, 1888, and May 9, 1889, the taxes levied on matches are: 1. the excise collected from the band labels on the boxes 2. the license duties granting the right to establish match factories.

The excise upon the matches produced in Russia is: 1. a quarter of a kopeck per box containing not more than 75 matches; 2. half a kopeck per box containing from 75 to 150; three-quarters of a kopeck per box containing from 150 to 225; and one kopeck per box containing from 225 to 300 matches. The duties on the imported matches, notwithstanding the customs duty levied thereon, is double the above-mentioned. According to the law of November 16, 1892, the excise on phosphorous matches is twice as large as that on safety matches.

The license duties are: 1. for factories with hand machines, 50 roubles per year; 2. for those having horse motors, 100 roubles; 3. for those moved by steam engines, 150 roubles.



CHAPTER XV.

The Naphtha Industry.

THE exploitation and treatment of naphtha gives an instance of the rapidity which mining and industrial enterprise can attain in Russia, if only the combined circumstances be favourable. In giving a concise description of this industry, which has already been partially treated in the volume upon the Mining and Metallurgical industries, it is first necessary to mention that the exploitation of raw naphtha is mainly concentrated on the Apsheron peninsula near Baku, although it is also carried on, but in a far smaller extent, on the Cuban, in the province of Tersk, and other localities. There are signs of the occurrence of naphtha in many other parts of Russia besides the Caucasus, but the majority of these localities have not yet been exploited, or even sufficiently surveyed.

The statistical data of the production of naphtha in past years, especially before the seventies, are not reliable; and in the more recent data, especially since the yearly appearance of numerous naphtha fountains from the sinking of wells, there are doubtful figures reaching to as much as several million pounds. In the fifties the production did not exceed 300,000 pounds, and was not under 150,000 pounds. In 1860 to 1865 it varied between 300,000 and 800,000 pounds, and in 1865 to 1870, between one and two million pounds per year. Therefore the author only gives the data of the production in millions of pounds, all the more as even in recent years, when the data are collected both by the representatives of the mining and excise offices, and by persons elected at the meetings of the naphtha traders, the estimates from different sources often differ by whole millions of pounds. Moreover, for facilitating comparison, the author adjoins the data for the production, expressed in American barrels, taking the capacity of a barrel at forty gallons. As the weight of a gallon of water is equal to 0.277 Russian pounds, therefore a barrel will hold 11.08 pounds of water, and as the density of the chief mass of the Apsheron naphtha is about 0.875, it may be said that a barrel contains on the average 9.7 pounds of naphtha; and this is the figure taken by the author for expressing the production in barrels.

The density of the American naphtha is less, and frequently only 0.82. In that case a barrel of 40 gallons would weigh 9.0 pounds. This is the figure taken for converting the barrels of American naphtha into pounds. As an example the author cites the production of naphtha in the United States in pounds, according to «Stowel's Petroleum Reporter». The legal barrel of 40 gallons is taken, and not of 42 gallons, which Stowel takes.

Y E A R S.	POUNDS.	BARRELS.
1875.	85,000,000 =	9,500,000
1880.	149,000,000 =	16,500,000
1885.	224,000,000 =	25,000,000
1891.	331,000,000 =	36,500,000

The following table gives the amount of naphtha obtained in Russia during the last twenty-two years, expressed in millions of pounds and millions of barrels.

YEARS.	Million pounds.	Million barrels.	YEARS.	Million pounds.	Million barrels.	YEARS.	Million pounds.	Million barrels.
1870	1 ³ / ₄	0.2	1877	14	1.4	1884	90	9.3
1871	2	0.2	1878	22	2.3	1885	116	12
1872	3	0.3	1879	25	2.6	1886	145	15
1873	5	0.5	1880	31	3.2	1887	166	17
1874	6	0.6	1881	41	4.2	1888	194	20
1875	7	0.7	1882	51	5.3	1889	207	21
1876	12	1.2	1883	60	6.2	1890	241	25

Thus from 1870 to January 1891 altogether about 1,440,000,000 pounds, or about 149,000,000 barrels were obtained. Although the industry still remains almost entirely concentrated in the neighbourhood of Baku, still the production continues increasing every year. The data for 1891 are given below.

ON THE APSHERON PENINSULA.		IN OTHER PARTS OF RUSSIA.	
P o u n d s.	Barrels.	P o u n d s.	Barrels.
288,800,000	29,700,000	2,300,000	200,000
Total: 291,100,000 pounds, 29,900,000 barrels.			

Complete data are still wanting for 1892, but it is known that the yield on the Apsheron peninsula was 298.3 million pounds, or increased by 1,000,000 barrels.

The above data show that during the period of the last five years as much naphtha has been produced as during the previous twenty years, and there is no doubt that such a rapid exploitation would ultimately exhaust any other similarly small naphtha region as that of Baku, only 6 square kilometres in area, did there not exist the conditions of an unusually rich and still perfectly fresh, in a geological sense, deposit of naphtha. Indeed, geological surveys of the locality, conducted by many Russian geologists show that the stratum of the naphtha-bearing sands of the Apsheron peninsula, and other parts of the Caucasus, belongs to the tertiary formations, that is, to the comparatively recent geological epoch of the upheaval of the Caucasian range.

The traces of the remains of a yet existant geological activity are seen in the mud volcanoes which bound the naphtha deposit on one side of the Apsheron peninsula. Without touching upon the yet contested question of the origin of naphtha, or of the material from which it is formed, it is impossible not to look upon the above circumstance as one of the causes of the richness of such naphtha deposits as that on the Apsheron peninsula, compared with those which contain naphtha in strata, belonging to more ancient geological periods, such as the Devonian; because many local conditions might arise in the course of geological time, for the escape of the naphtha from the strata, and in general for diminishing the amount fit for exploitation.

The escape of naphtha from the soil and hills, and other advantages of its application to the industries, were known to the natives of the Caucasus very long ago, and they collected the oil, and dug wells for its exploitation. Previous to its annexation to Russia in 1813 the Apsheron peninsula contained a great many of these wells, which were rented out by the khans to the inhabitants, who employed the oil to the amount of one to two thousand pounds, not only as a medicine against many diseases, but also for the two objects for which it is now used, that is, for lighting in *chiraks*, or peculiar clay lamps resembling the ancient Greek lamps, and as a lubricant for the axles of the *arbas*, or heavy native two-wheeled carts. Long ago the unrefined native naphtha was used for similar purposes on the Couban and Terek in the northern districts of the Caucasus. When the khanate of Baku became Russian, the wells were farmed out, and the idea then arose of obtaining an illuminating oil by distilling the raw material.

The first Russian experiments made by Mr. Doubinin in 1823 were made long before the application of photogen, (an illuminant produced by the distillation of boghead and peat), and kerosene, (a light naphtha illuminating oil). But these experiments did not lead to any practical results, chiefly owing to the fact that the farmers of the naphtha wells, who had a monopoly and only a temporary holding of the wells, had not the possibility of, or any direct interest in, introducing new improvements and measures which would require prolonged and persistent energy and expense. These measures and improvements were, however accomplished, and started in the sixties, chiefly owing to the endeavours of two individuals whose names have the same importance in the Russian naphtha industry as that of Colonel Drake in the United States industry. These two individuals began their labours at

the two extremities of the Caucasus: the one, Colonel A. N. Novosiltsev, on the Kouban, that is, at the north-west extremity of the Caucasian range; and the other, V. A. Kokorev, on the Apsheron peninsula, that is, at the south-eastern extremity of the Caucasian range.

Moreover, both these localities were near the sea, the first near the Black and Azov seas, where Colonel Novosiltsev erected his naphtha distilling works at Fanagoria, while Kokorev took advantage of the combustible gases which are evolved at Sourakhany, 17 versts from Baku, for conducting the distillation of the naphtha. These gases escape from natural crevices, and in ancient times formed motive for the erection of a temple of the Indian fire worshippers. Kokorev's works, which are situated alongside of the walls of the above mentioned temple, were erected in 1859, and when the author first visited them in 1863, they were already distilling naphtha bought from the farmer at 40 kopecks a poud, and transporting the refined kerosene in barrels to the interior of Russia, where it competed with the American oil along the Volga.

On the Kouban, A. N. Novosiltsev proceeded in another manner; he rented a large area of land from the Kouban Cossacks, and began to explore the localities by boring wells, which led to the appearance of the first naphtha fountain, and induced Mr. Novosiltsev to erect the Fanagoria works. But the great labour devoted to the exploitation and treatment of the naphtha in this region did not lead to the desired end, not for want of material, but owing to the accumulation of debts and want of capital; so that the Kouban naphtha industry, which began so brilliantly, hardly has dragged on its existence to the present day, since the death of A. N. Novosiltsev.

The Kouban naphtha industry was divided during the lifetime of Colonel Novosiltsev; the estate of Koudako passed from his hands, and after his death a trusteeship was formed, which first rented the industry to an American, Mr. Tweddle, and then in 1883 to a share organization known as the Russian Standard Oil Co., but these new enterprises were not successful in their dealings. And although 94 wells were sunk the majority of them were small, about 200 feet, or 30 sagenes, deep, and although 39 of these wells are under exploitation, still they give out little naphtha, due mainly to the district not having been sufficiently explored. The yield in 1889 was 1,333,333 pouds, and in 1890, 1,800,000 pouds. Judging from existing data, the Kouban naphtha deposits have a greater resemblance to the American deposits, in the small yield of the wells, than to the Baku fields. But the comparative proximity to the Black Sea, which is free and does not freeze, gives the Kouban industry a great advantage. It was otherwise in the neighbourhood of Baku. Here, at the end of the sixties and beginning of the seventies, the first wells, and especially those sunk by Mr. Bourmeister, immediately proved productive, and frequently gave abundant, continuous, or periodic fountains of naphtha, which at Baku, as in America, were the chief means of attracting general attention to the vast stores of naphtha and gases held in the sandstone strata beneath the naphtha-bearing areas. The success which the first wells and distilling works had at Baku, evoked competition, and numbers of small distilling works were erected at Baku, which bought their naphtha from the farmers at 20 to 45 kopecks per poud, and sold the refined kerosene from 1 to 2 roubles per poud on the spot, or about 3 roubles per poud at Nizhni-Novgorod. The kerosene was sold in barrels which cost

about 40 kopecks per pound of kerosene. The naphtha fountains, the tendency towards the exploitation and treatment of the crude oil, the increased importation of American kerosene, and the comparatively small revenue of 100,000 to 162,000 roubles, brought by the farming out of the naphtha wells, together with the introduction of a civil routine after the pacification of the Caucasus, and especially the persistent scientific and mercantile indications of the possibility of founding a vast naphtha industry at Baku, induced the Government in 1872, to sell by auction the use of the chief naphtha-bearing areas, situated in the Crown lands near Baku. The conditions of sale were that the buyers were to pay a rental of 10 roubles per dessiatine for the land, and an excise upon the capacity of the stills, of about 15 to 25 kopecks per pound of kerosene. Notwithstanding these onerous conditions, land for nearly three million roubles was sold at the auction, and the exploitation and treatment of naphtha attracted many individuals to Baku, so that in 1874 the industry of the district made most rapid strides, and numerous borings were made and works erected, forming a special suburb of Baku known as the «Black town». Then means of transporting the kerosene by sea, and along the Volga, were devised, and, what was more important, the kerosene consumed in the interior began to decline in price, notwithstanding the excise, while the consumption extended and gradually displaced the American article. At that time, however, the quality of the Baku kerosene, and especially of that prepared at the small works, was unsatisfactory, owing to the fact that in order to diminish the excise dues, levied on the capacity of the stills and the time taken for the distillation, the latter process was conducted too rapidly, and owing to the high price of sulphuric acid transported from the Kama, and of caustic soda brought from abroad, the refining of the raw naphtha was imperfect. Competition, also, lowered the price and led to a crisis. To stop which, and at the same time facilitate the development and exportation of naphtha products, the Government in 1877 removed the excise from kerosene. In doing so the Government was guided by the results of experience and by the example of the United States, where naphtha and kerosene were also at first subject to an excise.

After this the Baku naphtha industry became perfectly free, and made rapid progress both in a qualitative and quantitative respect. This was greatly aided by the counsels of Russian scientific men upon the treatment of naphtha, and by the formation of large enterprises, and especially of the companies of A. E. Nobel and V. I. Ragozin. The first was established at Baku, and started large tank steamers and vessels for transporting the naphtha and kerosene by the Caspian Sea and the Volga.

This company also introduced a system of tank trucks upon the railways, and was the first in Russia to erect large iron reservoirs for storing the naphtha, kerosene, and naphtha refuse, and to establish a foreign trade in Russian kerosene, although for this purpose it had to be transported to the ports of the Baltic and to the western frontier, because at that time the Transcaucasian Railway uniting Baku with the Black Sea ports did not exist. The chief service rendered by Ragozin and Co., who erected their works on the Volga, near Nizhni-Novgorod and Yaroslav, was that they were the first to obtain excellent lubricating oils and cerates (unrefined vaseline) from the Baku naphtha, besides kerosene of the American type. Moreover, they succeeded in bringing these lubricants into use not only in Russia but also in Western Europe. At that time, that is, at the end of the seventies and beginning of the eighties, the price

of kerosene fell rapidly to 30 and 40 kopecks per pound at Baku, and to 1 rouble at Nizhni-Novgorod. owing to the great increase in the production and treatment of naphtha; and its internal consumption increased so much, that is, to about twenty million pounds per year, that all the factories, peasant huts, and streets throughout Russia began to use kerosene for light. At the same time the competition of many of the small, and several of the large firms, soon brought the production to dimensions easily exceeding the home demand, which now does not use more than twenty-seven million pounds of kerosene a year; hence there arose an urgent necessity for increasing the foreign export of naphtha products. Although it had long gone along the lengthy route of the Caspian Sea, the Volga to Tsaritzin, and thence by rail to the western frontier, still the transport by this route, notwithstanding all the improvements and modes of economy, could not avoid raising the price of the oil, and thus hinder its extension abroad. The true foreign trade in Baku naphtha starts from the middle and even end of the eighties, when the Transcaucasian Railway was completed and its transporting capacity increased by the construction of the Souram tunnel, and the introduction of a sufficient number of tank trucks. The following table gives the rise in the export of naphtha products abroad.

Y E A R S.	Raw naphtha.	Mineral cerates, vaseline etc.	Benzine and other volatile naphtha oils.	Kerosene and other lighting oils.	LUBRICATING OILS.		Naphtha refuse.	Total in mil- lions of pounds.
					Refined.	Unrefined.		
	T H O U S A N D S P O U N D S.							
1881.	182	—	—	134	309	277	67	1.0
1882.	112	—	—	229	327	376	77	1.1
1883.	284	—	—	1,494	451	1,267	60	3.5
1884.	603	451	—	3,949	605	853	452	6.9
1885.	1,129	85	—	7,249	648	1,490	208	10.8
1886.	1,258	72	0.5	9,195	776	1,452	2,256	15.0
1887.	1,078	6	0.6	11,819	1,137	1,664	3,282	19.0
1888.	299	3	0.7	27,363	1,516	1,282	4,481	34.9
1889.	225	1	2	34,939	1,527	1,927	6,129	44.8
1890.	761	—	8	39,767	3,434	1,134	2,986	48.1
1891.	870	—	7	45,123	3,956	1,104	3,167	54.2
1892.	297	—	8	48,222	5,439	754	2,519	57.3 *

The distribution among foreign countries is seen from the export of lighting oils for 1889 in the following table.

* According to the customs estimate, for 27 million roubles, or on the average at 47 kopecks per pound.

COUNTRIES.	Thousands of pounds.
Great Britain	6,865
Austro-Hungary	4,010
Germany.	2,783
France	45
Italy	2,042
Belgium.	1,841
Holland.	538
Roumania.	527
Spain.	519
Denmark	468
Norway and Sweden	413
Greece	46
Turkey	7,483
Persia.	366
East India.	5,201
China	1,020
Japan.	330

Out of the 54 million pounds of naphtha and naphtha products exported, in 1891, 48 million pounds passed through the port of Batoum, which clearly shows that the export trade depends directly upon the transport capacity of the Transcaucasian Railway, which now transports about 60 million pounds of naphtha goods from Baku per year. Before arriving at Batoum and the intermediate stations, a portion of the naphtha goods go to Odessa and other Black Sea ports. The transport of about 60 million pounds, or nearly one million tons, a year in one direction by a single-line railway, is doubtless nearly the possible maximum; and this clearly shows that to transport the huge excess of over 250 million pounds of naphtha obtained in the neighbourhood of Baku, other routes must be devised for a profitable commercial traffic of the mass of naphtha goods between Baku and the ports of Batoum, Poti, Novorossiisk, and others, open for the international trade of the Black Sea, which in respect to the Caucasian naphtha, plays the same part as the shores of the Atlantic ocean for the naphtha of the United States. There, as is well known, the oil springs are connected with the ocean ports, or, strictly speaking, the distilling works situated around them, by means of numerous long pipe lines, giving the possibility of supplying the raw naphtha in the requisite quantity independently of the railways; such a pipe line, which would not only lower the cost of transport between Baku and Batoum, a distance of 840 versts, but also increase the export of naphtha products abroad, does not yet exist in the Caucasus. At the close of the eighties the question of the laying down of a pipe line between Baku and Batoum was much discussed in the Ministry of Imperial Domains, the Society for the Encouragement of Russian Industries, and by the Imperial Russian Technical Society; and the majority of opinions were fully agreed upon the urgent necessity and timeliness of

this measure. But nevertheless it was delayed and has not yet been realized, owing chiefly to the three following reasons: 1. The pipe line would necessarily decrease the transport of naphtha goods along the Transcaucasian Railway, which was at first guaranteed by the Government, and has now passed into the hands of the Crown, and was partly constructed for the purpose of transporting naphtha goods; 2. The centre of the naphtha industry, which is now at Baku, would be transferred to the shores of the Black Sea at Batoum and Poti, and this would revolutionize the existing order of the industry; 3. The Volga region and works in the interior of Russia would be deprived of naphtha refuse, which is an indispensable fuel in these localities. Although these arguments are evidently insufficient for solving the question, nevertheless for the time being they have taken the upper hand, and the pipe line still remains a question of essential importance. In speaking of this, one cannot but mention that: *a.* although the production of naphtha at Baku increases every year, still it becomes more difficult, and the wells have to be sunk deeper, and to be more numerous, and therefore the conditions of the greatest advantage of the pipe line have become modified; *b.* that the naphtha refuse, which could be used in manufactures with great profit on the coasts of the Black Sea, is now consumed as fuel; *c.* that the extended consumption of naphtha refuse in Russia retards the development and growth of the coal industry, especially in the Donets and Urals. The absence of a pipe line between Baku and Batoum forms an evident want in the development of the Russian naphtha industry; and its results will certainly reflect themselves upon this business, which in all other respects is a model industry in Russia. Thus, for the last twenty years, the production of raw naphtha in Baku has outgrown the means existing for its distillation into valuable products, and the existing conditions of trade in these products. In a word, here as elsewhere, the production of the raw material has, notwithstanding the evident commercial successes, taken the upper hand, or outstripped the manufacture and trade, and this is chiefly due to the richness of the natural productive forces of Russia. The Caucasian naphtha wealth can be best likened to the wealth of North and South America, of Chili and Bolivia, in copper and silver. One discovery is followed by another, only that portion is taken which is most easily gained, the prices fall, the conditions for the extension of the production decrease, a portion of the enterprises ceases working, and yet the total production increases to such an extent that the general prices of the products fall, and the universal demand in respect to quality increases. Such an order of things must lead to an extension of the demand for like mineral products, and the discovery of means for covering the losses in value by increasing the production.

In order to clearly state the present position of the Russian naphtha industry it is necessary to consider: *a.* the division of the Baku naphtha into different products, and more particularly the composition of this naphtha and the possibility of its entire utilization; *b.* the importance of naphtha refuse as a fuel; *c.* the conditions of the exploitation of the naphtha deposits.

THE BAKU NAPHTHA PRODUCTS.

Although the area of the immediate Baku naphtha bearing district is rather uniform and very small, about 554 dessiatines, or 6.3 square kilometres, although the

number of wells under exploitation is also small, namely 458 in 1891; and although the low prices long existing in the Baku district * almost forbid the exploitation of any but the rich wells, giving over 500 pounds per day, and necessitate the abandoning of those localities which give a thick, heavy naphtha, from the fact that such naphtha flows too slowly through the pipes, and gives but little of the ordinary kerosene, yet, notwithstanding these drawbacks, the naphtha obtained in the neighbourhood of Baku is far from being uniform in its component elements or qualities.

The light «white» naphtha, of specific gravity about 0.78 (15° C.), is now obtained at Sourakhany in too small quantities to deserve special mention. The wells situated to the south of Baku at a distance of only 4 to 6 versts, at the village Beibat or Bebi-Eibat, where in 1873 Mr. Tagiev started a regular exploitation and manufacture at his own works, give a lighter naphtha, sp. gr. 0.86, compared to the other kinds obtained in the Balakhano-Sabounchinsk and Romaninsk districts to the north-west of Baku, and where the majority of the wells are situated. This predominating naphtha, having a specific gravity of 0.86 to 0.88, and even 0.885, is called «green» owing to the green fluorescent rays it emits, although the transmitted light is brown, and forms the chief source of the Baku naphtha products; the «black» heavier naphtha of the neighbouring Binagadinsk district has a specific gravity of about 0.9 and above; at present it is but little worked, although it might be exploited in large quantities and advantageously employed as a fuel. Without entering into an examination of the chemical composition of the various kinds of Baku naphtha or lingering over its numerous technical analyses, by fractional distillation, it is necessary to cite the following fundamental data respecting the practical application of the oil, and moreover for the sake of clearness to compare these data with those for the Pennsylvania field.

AMERICAN NAPHTHA.

1. At the same boiling point, the Baku naphtha gives heavier products than the American, or products of equal specific gravity distill over at a lower temperature from the Baku naphtha than from the American.

2. The amount of carbon in the products of similar technical application, or like boiling points, is greater in the Baku naphtha than in the American, and therefore the lighting and lubricating capacity of the former is greater than that of the latter.

3. The amount of light volatile products of distillation, such as gasoline, benzine, et cetera, is far less in the Baku than in the American oil, and therefore the former can more easily give a safety lighting oil of the ordinary type, that is, kerosene or petroleum, than the American oil.

4. The ordinary Baku naphtha, of sp. gr. 0.87 to 0.88, gives 25 to 30 per cent by weight of such a kerosene which, having a sp. gr. of about 0.81 to 0.83,

* The price of raw naphtha at the wells depends upon the demand of the works, and on the existence of a naphtha fountain at a given moment. Thus the price varies very rapidly and considerably. In 1890 it was in general high, from 4 to 9 kopecks per pound, while in 1891 it was low, from 1½ to 4 kopecks per pound, and averaged 2½ kopecks. The price at the works is ¼ kopeck higher than at the wells, owing to the cost of transport.

burns in ordinary lamps constructed for burning the American oil; and has, owing to the removal of the more volatile components, a flash point of about 25 to 30° in Abel-Pensk's apparatus.

5. The Baku naphtha yields from 40 to 50 per cent by weight of heavy safety lighting oil, or Baku oil, having a specific gravity of 0.82 to 0.84 and a flash point of 40° to 60° C. But the safety oil, which is far better than the ordinary kerosene, requires lamps having a short distance between the wick and reservoir, and a regular current of air: and although such lamps are to be found, still they are made in far less quantities than those designed for burning the common and more dangerous oil of the American type.

6. After separating from the Baku naphtha those lighter products which give the ordinary kerosene of the American type, there remain from 10 to 30 per cent by weight of an intermediate, so-called solar or light house oil, of specific gravity 0.84 to 0.88, which is an entirely safe illuminant, its flash point being very high, from 60° to 100° C. and above, and which can be perfectly well burned in lamps specially constructed for the purpose, and capable of burning even a mixture of all the refined products of the distillation of naphtha, forming from 80 to 85 per cent by weight of the raw Baku naphtha, and a perfectly safe means of illumination, as the author demonstrated before the Russian Physico-Chemical Society in 1883, Vol. XV, p. 271.

7. After separating the benzine, kerosene, and intermediary oil from the Baku naphtha and continuing the distillation with superheated steam, about 10 to 30 per cent by weight of lubricating oils are obtained. These oils do not solidify in the cold, nor oxidize in the air, after prolonged purification with sulphuric acid and caustic soda, and have a specific gravity from 0.87 to 0.91, and a flash point above 100° C.; they are also suitable for every kind of lubrication.

8. After the distillation of these lubricating oils, the Baku naphtha gives a heavy refuse which, when distilled with the aid of highly superheated steam at 350° to 400° C., splits up with the formation of gaseous and volatile hydrocarbons into: *a.* a product which solidifies in the cold, and is known as «naphtha tallow» or *sebonaphth*, which contains solid paraffins and, after the requisite purification, vaseline to the amount of 5 to 10 per cent of the raw naphtha; *b.* liquid hydrocarbons (their amount increases at the expense of the vaseline, as the pressure under which the distillation is carried on increases) suitable after refining for lighting in kerosene lamps: these products of decomposition were first investigated by the author, (Journal of the Russian Physico-Chemical Society, 1881, Vol. XIII, p. 456) and are now being studied by V. E. Tishchenko; *c.* combustible gaseous hydrocarbons having a high illuminating power, and serviceable as a fuel for the distillation of the raw naphtha.

Thus, the Baku naphtha is capable, as the author proved by researches which he carried out on a large scale at the Constantinov Works, of being totally distilled, that is, without leaving any carboniferous residue, and of giving a series of most useful products, which from the cheapness of the primary material and transport are open to a universal sale. But in reality such a perfect distillation or utilization of the Baku naphtha is at present impossible, owing to the fact that by this means 100 parts by weight of Baku naphtha give, after deducting those portions which are wasted

in the processes of distillation and purification, and which have to be consumed for conducting the actual process of distillation, not more than 80 parts of useful products. Hence the 280 million pounds of naphtha now produced should give about 225 million pounds of products. Out of this amount only 60, or at most 80 million pounds could be cheaply and profitably exported through the Transcaucasian Railway from Baku to Batoum for foreign consumption and 30, or at most 40 million pounds can be transported along the Volga for home consumption; this forms a total of from 90 to 120 million pounds per annum, that is, about one-third of the annual production of naphtha, or less than half of the possible amount of naphtha products.

Moreover, the entire utilization of the Baku naphtha is dependent upon the construction of lamps designed for burning the heavy safety oils, and this requires a particularly great perseverance, and forms a matter for the immediate future, and which can only be realized when the laying down of the Baku-Batoum pipe line gives the possibility of transporting from Baku not only those 50 to 70 million pounds of naphtha products which the railway is capable of carrying, but also raw naphtha to be treated on the shores of the Black Sea. As the matter now stands, the treatment of the Baku naphtha tends towards the production of only 30 per cent of distillation products, while the remainder forms the so-called refuse, consisting of the mixture which remains after distilling off the kerosene, when the ordinary light refuse is obtained, or after the distillation of the kerosene, intermediary, and lubricating oils, when the heavy abovementioned refuse is obtained. This refuse is employed as fuel in the place of coal, and is produced to the amount of about two-thirds of the weight of the raw Baku oil. A portion of this quantity, is consumed in the processes of distillation at the naphtha works themselves, and a far smaller amount is sold and exported, as is seen in the following data relating to Baku.

AT THE APSHERON PENINSULA	1890.	1891.
Total number of works	149	135
Number of works in action	103	100
» » » inactive	46	35
Amount of naphtha treated at these works in million pounds	220	247
Amount of benzine, obtained at these works, in million of pounds	0.5	0.5
Amount of kerosene of different kinds, in million pounds.	70	79
Amount of lubricating oil obtained from the naphtha .	5.5	6.2
Total production of distillation products, in million pounds.	76	85.7
Percentage of distillation products obtained	34.5	34.7
Naphtha refuse exported from Baku, in million pounds .	96	103
Percentage of naphtha refuse exported	43.6	41.7
Loss and expenditure in fuel on the spot at the works, stores, town et cetera	22	23.6 per cent.

It is known that, in 1891, 35 million pounds of refuse, or 14 per cent, were consumed in the processes of distillation et cetera, and for other local requirements; hence the actual loss is about 10 per cent of the total amount of naphtha treated at the works, and this loss is mainly due to the fact that, owing to the great cheapness of the raw naphtha, about 3 kopecks at the works in 1891, it is treated without any care, all the more so as in that year the price of the refined kerosene fell to 7 kopecks per pound, and the price of the refuse was about 4 kopecks per pound, that is, higher than that of the raw naphtha. All this shows clearly that the chief product of the Baku naphtha works is the naphtha refuse, and that the most important and, from their varied properties, valuable component parts of the Baku naphtha, such as the safety oil, vaseline, et cetera, are now burned as simple fuel without finding their proper and more valuable applications.

THE IMPORTANCE OF NAPHTHA FUEL.

The common raw Baku naphtha, containing as it does highly volatile benzine and kerosene, cannot be used directly as fuel owing to its inflammability and danger from fire. But those varieties of heavy natural Caucasian naphtha such as the Bina-godinsk naphtha near Baku, and many of the Kouban, Groznensk, Shemakhinsk and Transcaspian naphthas, which do not contain kerosene, lubricating and paraffine oils, or contain very little, as well as the refuse obtained in the treatment of raw naphtha, composed almost entirely of a mixture of hydrocarbons as they are, form a first class fuel in every respect. Such are the Baku naphtha refuse. Now, when in the absence of a Baku-Batoum pipe line it is impossible to utilize the entire mass of the naphtha produced, the employment of this refuse as fuel forms the most natural, although exclusively temporary phenomenon which Russia now takes advantage of to a somewhat large extent. Thus, about 140 million pounds of naphtha refuse are now annually consumed in Russia, about 30 million pounds being used at Baku itself for the naphtha and other local works; about 10 million pounds in other parts of Transcaucasia and in the Transcaspian regions; and about 100 million pounds on the Caspian Sea and Volga, and in the interior. It must be remembered that, when the Baku refuse obtained from the ordinary naphtha yielding kerosene and lubricating oils finds another and more valuable application as a source of safety oils, vaseline and illuminating gas, this refuse might be replaced not only by coal from the Donets and Urals, which might be transported along the Donets-Volga Railway and river Kama respectively, but also by the heavy natural naphtha which is abundantly distributed over the Caucasus, but is not at present exploited owing to the excess of the lighter ordinary Baku naphtha.

Leaving aside the question of the possibility of a more valuable utilization of this naphtha, the high qualities of the naphtha fuel far surpass those of the best kinds of coal even in respect to their calorific power, not to mention other advantages such as facility of carriage, safety for storage, generally in iron reservoirs, the absence of the necessity of stokerage, the uniform supply of fresh fuel to the hearth, the facility of having a total intermixture with the air by means of various kinds of pulverizers or tzers, the easy possibility of obtaining a maximum temperature, and the

simplicity of the construction of the furnaces. Naphtha and naphtha refuse, when burned in the calorimeter, evolve relative to their composition, and according to the determinations of many investigators, about 11,000 units of heat, for instance according to Mahler in 1892, 10,800 units; while the best kinds of coal do not evolve more than 7,400 heat-units. This relation requires the substitution of 100 parts by weight of coal by only 67 parts by weight of naphtha refuse, and this proportion is actually observed in the heating of boilers and locomotives by these two kinds of fuel. As Henri St. Claire Deville long ago showed, naphtha fuel is more advantageous than coal, and even than coke, in all furnaces which require a high temperature, such as smithy hearths and foundry furnaces.

This is due in the first place to the fact that naphtha contains a high percentage of hydrogen and no oxygen, and in the second place, which is still more important because naphtha fuel when properly regulated may be totally combusted like a combustible gas, without any excess of air, which is impossible with coal or coke if not converted into generator gases. A no less important quality in certain cases, as for instance in vessels of the fleet and in the centre of towns, is the faculty possessed by naphtha fuel of entirely burning under boilers and stoves without any trace of smoke, and of giving a flame of any required length, as well as of heating very rapidly. In a word, naphtha fuel must be regarded as the best form of fuel yet known. It is applicable to any kind of heating, for instance to house heating, kitchen and baker ovens, to steamers, locomotives, and other steam engines, and also to metallurgical and glass furnaces. Its application to these purposes is almost exclusively carried on in Russia, because this is the only country where it is cheap. During recent years its price at Baku varied between 3 and 6 kopecks per pound, and along the Volga from Tsaritsin to Nizhni from 10 to 20 kopecks, and in Moscow from 20 to 30 kopecks; but the price tends rather to fall than rise, because the amount of refuse produced at Baku increases every year, and the transport by water becomes cheaper, and the reservoirs or stores are everywhere increasing in number.

These low prices have resulted in naphtha fuel being employed in the steamers, coursing the entire system of the middle and lower reaches of the Volga and Kama, and on all those navigating the Caspian Sea, as well as on the railways adjoining these water ways, especially the Transcaucasian and Transcaspian railways. And these railways are greatly indebted to naphtha for their very existence, because the shores of the Caspian and the lowlands of the Volga, owing to their poor forest vegetation and the absence of workable seams of coal, are deprived of any other form of fuel, and the naphtha which occurs both on the west near the Sea of Bailov and on the Apsheron peninsula and near Petrovsk, and also on the east shore of the Caspian, on the island of Cheleken, and the adjoining ports of the Transcaspian region: especially the heavier kinds of naphtha present the most natural if not the only local fuel. In other parts of the Empire naphtha fuel must be regarded as an exceptional and in some cases valuable material, as for instance for obtaining high temperatures, for use on board the Men of War, owing to its giving no smoke, and for obtaining a rich illuminating gas. When naphtha refuse is suddenly subjected to a high temperature in gas retorts, it gives a gas which is very rich in heavy hydrocarbons, and very luminous. But for the ordinary purposes of heating and especially for boiler heating, where any kind of fuel is applicable, an extended em-

ployment of such a valuable product as the refuse can be only temporary in such transitional moments of the industrial activity of a country such as Russia is now passing through, when the industry has not yet succeeded in laying itself in the true course of the stream, which is now everywhere dependent upon the employment of coal.

From the point of view of its quantity naphtha fuel can only have a small fraction of the importance which coal has, as is sufficiently proved by the fact that the production of coal over the earth is now over 500 million tons, while that of naphtha is about 10 million tons; that is, if all the naphtha were employed as fuel it would, upon the estimation that one ton of naphtha is equal to one and a half tons of coal, only replace 3 per cent of the coal now consumed. Thus, the present consumption of 130 million pounds of naphtha refuse in Russia, must be regarded as a temporary phenomenon, dependent on the one hand, upon the want of a market for the excess of naphtha, and on the other hand, upon a want of activity in the exploitation of the Russian coal, which is so widely distributed over the Empire, and especially in the centre and south-east. The laying down of the Baku-Batoum pipe line, the regulation of the course of the rivers Don and Donets, whose water courses are several times greater than the basins of such rivers as the Rhine, the construction of railways from the Donets coal district to the Volga, and such like measures for utilizing the naphtha stores of the Volga and for a cheap mode of transport for the Donets coal, form an immediate problem in the industrial life of Russia, and will put an end to the irrationally large consumption of the Baku naphtha refuse for steam power which is now practised. There is no reason for thinking that, even were the employment of naphtha refuse as fuel entirely stopped, it would be prejudicial to the steam navigation of the Caspian and lower courses of the Volga, because at first this refuse would be replaced by the heavy kinds of naphtha, and after a time by the Donets and Ural coal. Moreover, the author is of the opinion that coal seams should be found in the Kolmuk steppes between the Donets and Volga, and the exploitation of this coal would have great influence upon the shores of the Caspian Sea.

NAPHTHA INDUSTRY ON THE APSHERON PENINSULA.

The mode of occurrence of naphtha in the Caucasus differs from that in America, as shown by the fact that in the United States there are tens of thousands of wells under exploitation in order to obtain 300,000,000 pounds of naphtha per year, while at Baku 500 wells yield the same quantity of oil. The Caucasus deposits may be regarded as sufficiently investigated from the point of view of its exploitation for the Apsheron peninsula only, because this district has not only contained numerous wells from very ancient times, but also owing to its being the object of full and systematically edited reports, which in recent years have been compiled by the Excise Department and by a special committee of the naphtha traders. The following forms an extract of the data for the last years.

The naphtha of the Apsheron peninsula is chiefly obtained from the wells by one of two methods: by means of buckets or fountains. The bucket system consists in lowering on a cable, by means of mechanical appliances such as windlasses or steam haulage

a deep bucket or cylinder having a valve at the bottom, and which raises the naphtha and water, and deposits into a gutter on the surface, leading to a reservoir. The dimensions of the buckets vary, but they are always large, bringing up as high as ten pounds at a time. In working upon this system, each well has its contingent of workmen, to the amount of not less than three per shift. More than four-fifths of the naphtha is extracted in this manner.

Fountains form an ordinary, if not a constant phenomenon in sinking wells in the neighbourhood of Baku, and some of these fountains have given, and continue to give some hundred thousand pounds of naphtha per day. They are always accompanied by the evolution of gases, and throw off water and sand and sometimes stones, which are often thrown up together with the naphtha to a height of 10, 20, and even 60 sagues.

The duration of the action, depending upon the pressure of the dissolved gases, and the mass of the naphtha cast up, depends upon the depth of the well and upon local conditions, but in general the deeper the well the more powerful the fountain. The naphtha thrown up by the fountains is collected, with every precaution against waste, by forcing helmets, or stopcocks, into the ends of the tubes lining the holes, and by this means directing the naphtha into reservoirs or pits. Still, a portion of the naphtha cast up is borne away by the wind and rushes into the earth, and sometimes destroys the derricks erected for the boring and bucketing, and then it flows into special pits, or into the neighbouring lakes and lowlands. The amount of naphtha collected in recent years from fountains is from 40 to 50 million pound as indicated below:

Naphtha obtained on the Apsheron peninsula:

1889, by bucketing	77 per cent;	by fountains,	23 per cent.
1890,	> 78	" "	22
1891,	= 85	" "	15

Thus, the amount of naphtha yielded by fountains has begun to decrease during the latter years; it should be observed, however, that although fountains are of rarer occurrence than before, still they are more abundant in naphtha than formerly. In any case, after a certain period of activity the fountains cease flowing, and then recourse has to be had to the bucket system.

In 1891 the 554 dessiatines of naphtha-bearing land of the Apsheron peninsula were divided among 95 different firms. This area consists of 300 dessiatines of private, and 194 dessiatines of State lands. However, only 77 of these firms carried on the actual exploitation of the naphtha. In 1891 there were 458 wells under exploitation; in 1888, 239; in 1889, 278; in 1890, 356; while the total number of wells in 1891 was 641. Out of the 458 wells exploited in 1891, 407 were situated in the Balakhan-Sabounchinsk area, 25 in the Romaninsk area, and 25 in the Beibatsk field. During 1891, 28 wells were abandoned as being unprofitable, and out of those newly sunk, 70 proved unfit for working, either owing to their yielding no naphtha at all, or because they gave so small an amount that it was impossible to work them with a profit. Out of the 458 wells exploited in 1891, 308 were old and 150 new, the average yield of the former was about 605,000 pounds in the year, and of the

latter, 590,000 pounds. As the bucketing system not only requires the current expenses of labour, but also the storage or sale of the naphtha, and as the number of reservoirs and the sale are at times, especially in the winter, insufficient, therefore the exploitation of many of the wells is only carried on during a certain season. Out of the 458 wells, which yielded naphtha in 1891, only 132 were worked during the whole year, 188, from six to eleven months, and 138 for less than half a year. The diameters of the tubes in 67 wells were from 6 to 10 inches, in 278 from 10 to 15 inches, and in the remainder over 15 inches, and none more than 22 inches. The average depth of all the wells worked in 1891 was 102.2 sagues or 715 feet; in 1890 this average was 94 feet, and at the commencement of the eighties it was only about 70 sagues; thus there is no doubt as to the depth of the profitable stratum for working, although it cannot be said that all the superficial strata are exhausted, because there are still holes sunk to a depth only from 50 to 70 sagues, and yet yielding as much as half a million pounds of naphtha per annum. However, there is no doubt that the depth which is the most profitable for exploitation, increases every year, and rather rapidly. Thus in 1890 the greatest average yield, about 1,333,333 pounds per well per annum, corresponded to those holes which were sunk to a depth of 120 to 130 sagues, while in 1891 the highest average yield of 1,500,000 pounds was given by a well sunk to a depth of 140 to 150 sagues. The total average annual yield for all the wells exploited was 803,000 pounds in 1888, about 692,000 pounds in 1889, about 636,000 pounds in 1890, and about 599,000 pounds in 1891 per well.

The average daily yield is also decreasing over all the naphtha areas, as the following figures show.

AVERAGE DAILY YIELD PER WELL.	1890.	1891.
Balakhan-Sabounchinsk area . . .	1,714	1,622
Romaninsk area.	1,431	1,386
Beibatsk	2,782	2,654

In looking at these figures it must not be forgotten that the total production of naphtha in 1891 was 50 million pounds, or 20 per cent greater than that of 1890, and that the number of active wells increased by 102, or almost 30 per cent. That is, in 1891 endeavours were made to cover the losses which were incurred by the fall of the price of naphtha, by increasing the production. Hence the number of wells sunk during recent years has increased. In 1889 fresh borings were conducted to a total depth of 6,500 sagues, in 1890 to a total depth of 14,810 sagues, and in 1891 to a total depth of 19,980 sagues. During these three years, altogether 284 new holes were sunk, namely 86 in 1889, and 151 in 1891. The cost of boring, including the cost of steam power, erection of derricks, and lining with tubes, is now on the average from 170 to 200 roubles per sagene, so that the total cost of the new holes sunk in recent times, is about four million roubles per annum.

If this yearly expense in boring be accepted, and the number of active wells be taken as 500, and the current expenses for labour, fuel, et cetera, per well per

year be 2,000 roubles, then the fundamental current expense of exploitation, not including the expense of administration, percentage on capital et cetera, will be 5 million roubles per annum, which, with a production of 250 to 300 million pounds, makes the cost of production per pound of naphtha one and two-thirds to two kopecks, whence it is clear that a market price of two and one-half kopecks at the wells in 1891 cannot repay the producers. It is evident that the price of raw naphtha must rise in the course of time.

Besides open pits capable of holding as high as 25 million pounds, for storing and settling the naphtha, there are in the neighbourhood of the wells covered earthen reservoirs having a total capacity of 6 million pounds, stone and brick reservoirs having a total capacity of 5 million pounds, wooden reservoirs of 1 million pounds capacity, and iron reservoirs of 5 million pounds capacity. Altogether, up to 40 million pounds can be stored at the wells, but as a rule the amount stored at one time is less, because the works situated about Baku buy up the naphtha for converting it into kerosene, and other products. The naphtha is transported from the wells to the works at a distance of from 8 to 17 versts, by means of 19 naphtha pipe lines, while there are 6 pipes for supplying sea water from Baku to the wells, and for feeding the boilers situated there.

The total length of these pipe lines is about 250 versts, and the cost of pumping the naphtha through them is generally about one-half kopeck per pound.

In order to characterize the position of the naphtha industry in the Caucasus, it will be enough to mention that in 1890 there were 135 works in action, yielding about 69 million pounds of illuminating oils. Out of these works, one belonging to Nobel Brothers and Co. produced about 18 million pounds of kerosene; four works, belonging to Tsatourov, The Caspian-Black Sea Company, Tagiev, and Shebaev and Co., each turned out from 4 to 5 million pounds, and eight works, over one and one-half million pounds each. Thus, 13 works yielded about 51 million pounds of kerosene, and consequently the remaining 122 belong to the order of small concerns. But these small works, especially in former years at the beginning of the eighties, had a great importance, because they did not permit the formation of any monopoly, and by their competition with the large works helped much towards lowering the price of the Caucasian naphtha products. The part played by the large concerns, especially in extending the market and in erecting stores, is naturally also very important; and thus there is that combination and competition of small and large producers, which is the most desirous for the successful growth of the industry. In speaking of the treatment of the naphtha at the works, it should be mentioned that, besides the 135 in the Caucasus, there are 32 in the interior of Russia, along the Volga near Yaroslav, in the neighbourhood of Moscow, and St. Petersburg, which either treat the raw naphtha * or the refuse, but their total production is far less than that of the Baku works, although their number increases every year. These few words on the Russian naphtha industry must be supplemented by a few data respecting the foreign export of naphtha products, and the customs and excise dues levied upon them.

* The export of raw naphtha from Baku to the Volga is equal to 5 to 6 million pounds per annum.

In Russia the illumination of houses and towns by lamps burning vegetable and animal oils began to be replaced by lamps burning liquid hydrocarbons, at the end of the fifties. This change was brought about by two equally important circumstances: in the first place, by the relative cheapness, in 1838 in St. Petersburg the cost of lighting by photogen being 4 roubles per pound; and in the second place, the greater facility of managing lamps burning the hydrocarbons. The material at first used for this purpose was photogen, which was obtained from peat, Scotch boghead, and bitumenous schists. It was imported and afterwards prepared in Russia from peat, imported boghead, and from the excellent boghead occurring in the government of Riazan. But the high price of this product, and the possibility of employing the cheap Russian turpentine, especially mixed with spirit, which mixture was largely used at the middle of the present century for street lighting in Russia, and above all, the appearance of the product of the distillation of the American naphtha upon the European markets, all these factors soon put an end to this mode of lighting houses and towns. The importation of photogen, and subsequently of American kerosene, naphtha, and lubricating oils across the European frontier, is given in the following table.

Y E A R S.	KEROSENE.	NAPHTHA.	LUBRICATING oils.
Thousands of pounds.			
1871	1,720	30	—
1872	1,798	98	8
1873	2,716	108	15
1874	2,532	105	8
1875	2,661	42	8
1876	2,679	56	16
1877	1,723	41	21
1878	2,004	55	15
1879	1,720	30	8
1880	1,453	26	8
1881	1,213	27	9
1882	1,047	16	8
1883	459	19	10
1884	276	14	7
1885	140	2	7
1886	46	0	6
1887	15	0	7
1888	12	0	7
1889	14	0	10
1890	8	0	15

The largest import occurred in 1876, at the very time when preparations were being made to remove the excise from kerosene and when the exploitation and treatment of the Baku naphtha began to rise rapidly. However, there is no doubt that the importation of foreign naphtha products gave the first impulse to the development and growth of the home naphtha production; and in this the part played by the customs duties was exceedingly important, in as much as they helped the pioneers of the home production to compete with the foreign exporters. The dimensions of the customs duties per pound net upon various naphtha goods are given in the following table.

	1868	1877	1881	1882
Raw naphtha . .	15 kop. paper	15 kop. gold	16½ kop. gold	17 kop. gold
Kerosene . . .	55 » »	55 » »	60½ » »	60 » »
Lubricating oils .	55 » »	55 » »	60½ » »	60 » »
	1885	1887	1890	1891
Raw naphtha . .	20 kop. gold	20 kop. gold	24 kop. gold	20 kop. gold
Kerosene . . .	70 » »	100 » »	120 » »	100 » »
Lubricating oils .	70 » »	70 » »	84 » »	100 » »

The increase of the import duty upon kerosene in 1887 corresponds to the placing of excise upon the oil consumed in the Empire.

The high customs duties during 1868 to 1878 undoubtedly had an important protective influence upon the development of the home production, and subsequently, when the industry had gained sufficient strength to render the customs protection unnecessary, they were retained as a protection against the importation of naphtha goods to the frontier towns situated at a distance from the Caucasus, and also as a defence over the large excise revenue from the kerosene of home production.

The customs duties upon Russian naphtha goods clearly demonstrate the impulse which high dues may give to the development of an internal and universal production, if only they answer to the internal store of raw material, and to the conditions of the country; and the Russian tariff of 1891 is firmly established upon that principle. They prove in the second place that high customs duties upon such a class of goods as naphtha, do not in any way prevent the prices from falling, as in Russia when the duty upon kerosene is equal to 20 kopecks gold, or 30 kopecks paper, the price of kerosene on the spot of production is equal to 7 to 20 kopecks, without excise, which is less than the customs duty. It is often said that with protective duties, the price of goods inside the country is always equal to the duty and the cost of production, that is, that the duty goes to the advantage of the producer. The instance in question distinctly contradicts this supposition, although only 25 years have passed since the rise of the naphtha industry in Russia.

After the customs duties, the most important factor in the development of the Russian naphtha industry, is the excise upon the illuminating oil of home production. It has already been said that the excise upon the capacity of the stills, to the extent of about 15 kopecks per pound, was only in force from 1873 to 1877. After its removal the industry made rapid advances, the consumption of kerosene began

to increase considerably, the export of naphtha products began to rise and the prices to fall rapidly, owing to home competition. This combination of circumstances, and especially the fact that, during 1877 to 1886, the price of kerosene declined by at least 60 to 80 kopecks per pound, the price being only 20 to 30 kopecks per pound, induced the Government, in view of the urgent requirements of the treasury, to again turn to an excise upon kerosene, which was introduced in 1888 to the amount of 40 kopecks paper per pound on ordinary kerosene, and 30 kopecks per pound on the heavy qualities of high flash point. Benzine, lubricating oils, raw naphtha, and naphtha refuse, were free from duties, as also were all naphtha products sent abroad. At the close of 1892 these dues were raised to 50 and 60 kopecks per pound, and the differences between the dues paid upon the heavy and ordinary kerosene were somewhat modified, although the main principles were preserved.

In 1888 . . 6.6 million roubles paper In 1890 . . 18.2 million roubles paper
 " 1889 . . 9.3 " " " " 1891 . . 10.2 " " "

These figures show that the imposition of an excise has, in raising the price, retarded the previous growth of the consumption. This is seen in the BB in the accompanying diagram, which gives the production of raw naphtha along AA, and the amount of naphtha products produced along CC, and hence AC gives the amount of refuse, and CB the export of naphtha products.

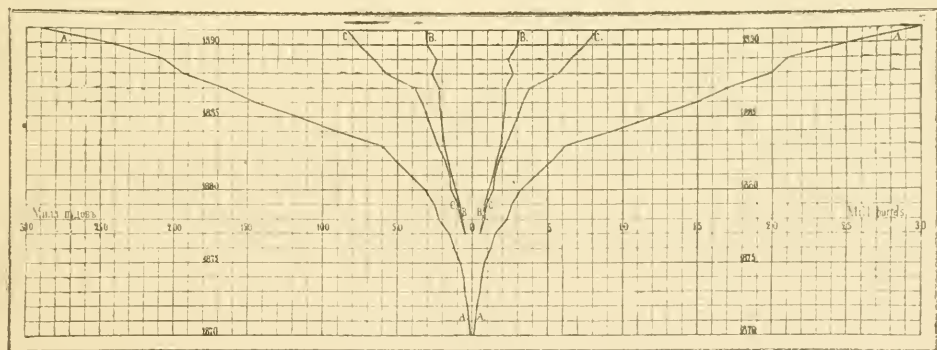


Diagram depicting the development of the Russian naphtha industry, from 1870 to 1891: to the left in million pounds, to the right in million barrels of 40 gallons capacity; AA production of raw naphtha, BB home consumption of kerosene and other lighting oils, CC amount of naphtha products.

In summing up the position of the Russian naphtha industry at the beginning of 1892 the result would be, in rough figures, the following:

Number of wells under exploitation	500
» » works distilling naphtha	167
» » » » » at Baku	135
» » » » » in other parts of Russia	32
Annual production of naphtha	290,000,000 pounds.

The naphthta collected is approximately distributed as follows:

1. The stores of naphthta increase by	15,000,000	pounds
2. Products of distillation are obtained to the amount of	90,000,000	»
Including lighting oils in Russia	30,000,000	»
» exported	47,000,000	»
» stored.	5,000,000	»
» other products, lubricating oils, and benzine for home and for- eign consumption	8,000,000	»
3. Naphthta refuse is obtained to the amount of	140,000,000	»
Of which Baku consumes	30,000,000	»
» transported by the Caspian and Volga	98,000,000	»
» to the Transcaspien region	3,000,000	»
» to Batoum	2,000,000	»
» to other parts of Caucasus	7,000,000	»
4. Loss of all kinds. gases et cetera, in refining	45,000,000	»
Total export of naphthta and naphthta products	54,000,000	»
(40 per cent of which went in 1892 to Asia).		
Price per pound of raw naphthta at Baku	3 to 5	kopecks
» » kerosene at Baku without excise and barrelling	7 to 20	»
» » » » Tsaritsin	25 to 40	»
» » » » Moscow	45 to 60	»
» » » » Batoum	30 to 45	»
Total value at the wells of the annual production of raw naphthta in Russia, that is, of about 290,000,000 pounds.	9,000,000	roubles
Value of lighting oils, without excise and barrelling, and of lubri- cating oils at the works. to the amount of 90,000,000 pounds	14,000,000	»
Value of refuse sold at the works to the amount of about 120,000,000 pounds	5,000,000	»
Freight of carriage of 200,000,000 pounds of naphthta and naphthta products, to the home markets and frontier customhouses, at an average of 20 kopecks per pound	40,000,000	»
Value of foreign export of naphthta goods, partly including bar- relling	30,000,000	»
Cost of sea freight for carrying 54,000,000 pounds of Russian naphthta goods to the foreign markets, at an average of 18 kopecks per pound	10,000,000	»
Excise revenue upon kerosene for home and Persian consumption.	10,000,000	»

These figures show that the naphthta industry itself is not so profitable to those occupied in the exploitation and treatment of it as to the carriers, and that in general the indirect revenue from naphthta is much greater than that obtained by those actually working it.



CHAPTER XVI.

Cements.

THE foundation of the manufacture of cements in Russia dates from the fifties of the present century, an epoch which is in general memorable in many respects, in the history of the making of cements throughout Europe. The position of affairs with respect to the manufacture of cements in the first quarter of this century is partially explained by the fact that the Roman methods of preparing cements, especially those designed for submarine works, had been lost and new ones had to be discovered.

Although at the very beginning of this century a special kind of local native material was found in England, and immediately after in France, which, after roasting, gave a cement of higher and more durable quality than hitherto made (J. Parker. nodules of clay; Lesage, galets de Boulogne); these cements were named «Roman cements» after the ancient makers. However, the development and general extension of the cement manufacture was barred by those elementary conditions to which it is in principle subject from its chemical aspect. It belongs to the number of those, perhaps few technical branches, whose foundation as an industrial manufacture cannot be accomplished by a method of initiation or transplantation from one soil to another by the customary empiricals of industry, notwithstanding that the actual technical processes and instruments of the manufacture are as simple as can be, consisting as they do of breaking up the material, roasting it in ovens of well known types, and then pulverizing it in mills.

Owing to the great variety of the lime stone rocks which can be used in this manufacture, it must at the very commencement be founded upon a clear knowledge of the elementary principles of chemistry, upon which a choice of the most suitable material and methods of manufacture are based. In the mean while chemical science, in which the question of the conditions and processes of the formation of the hydrated silicates, which harden under water, was always one of the most complex, notwithstanding its seeming simplicity, only gave its fundamental indications in comparatively recent times.

The chief basis of the matter was only laid towards the beginning of the second quarter of the present century, in the researches of Vica, which extended in their details over the whole of that quarter of a century and more. This famous French savant, after having discovered the first bases for making a choice of the material for the manufacture of the so-called natural Roman cements, and also of the artificial cements, travelled over the whole of France, and pointed out to the local builders and engineers the best localities for finding cement-making materials, and the most advantageous methods of converting them into cement. At that time, however, it was not everywhere that manufacturing industry and experimental science went thus hand in hand.

When in 1825, in practical England, there first appeared, as an undoubted echo of Vica's work, that now most important and highest branch of cement manufacture, the production of Portland cements prepared by the then little known method of strongly calcining the material to incipient vitrification, then the evident adaptability of this English manufacture to the original local material upon whose properties, it seemed to many, the incomparable qualities of the resultant products were exclusively dependent, was enough to guarantee to England a monopoly of this manufacture for fully twenty years. Even at the time of the London Universal Exhibition of 1851, the English savants said with conviction that the mixture of chalk and natural river silt, or the argillaceous deposit of some rivers running over clay and chalk, which they employed for the manufacture of Portland cement, could not be successfully replaced by any other artificial mixtures of limestones and clay; they said furthermore: «It is not difficult to procure artificially mixtures of limestone and clay, which are less costly than the natural kinds, though not equal in value» (Report of the Juries p. 573, Exhibition 1851). The English Portland cement became an important article of export, and very large quantities were furnished to the shores of the Arctic Ocean, Baltic Russian ports, and to France and Paris, where the English cement was particularly used in large quantities in the construction of the large northern ports. This state of affairs continued to the middle of the present century, and even in 1856 the experts of the Paris Universal Exhibition certified that, «notwithstanding the greatly extended use of the English Portland cement its manufacture had, contrary to all expectations, remained but little studied». This closes the first period of the history of the manufacture of cements.

During the fifties, the fundamental data, which were required to guide the development of this industry, began to increase rapidly, and at the same time the first endeavours were made to establish the manufacture of Portland cement on the Continent. It was proved in 1850 to 1851 that, when hydraulic limestones of a suitable composition are calcined to incipient softness, they give cements which conglomerate slowly, but attain an immense hardness in the course of time.

The manufacture of Portland cement in France in was first started 1850 at Boulogne-sur-mer, by Messrs. Dupont and Demarle; and almost simultaneously, in 1852, in Germany at Stettin. The manufacture at Stettin was founded upon a process elaborated by Dr. Bleibtree of Bonn. The process was similar to that practised in England; the cement was prepared from chalk and clay, extracted in the neighbourhood of Stettin. At that time England, recognizing its monopoly in the manufacture of cements, and the importance of this material for marine works, ceased

exporting its Portland cement to Russia, with which previous to the Crimean war it was in hostile relations. The export of cement from England to Russia was forbidden by a special decree of the Queen of England, and this was one of the chief reasons for the erection of cement works at Stettin. The Portland cement made at Stettin was from the first distinguished for its high qualities, and was chiefly manufactured for the Russian market (*Exposition Universelle 1855, rapports du Jury mixte international II*, 143).

Thus, the beginning of the fifties saw the establishment of the manufacture of Portland cement in France and Germany. At the same time, the first manufacturing enterprise dealing in cements was also initiated in Russia by a military engineer, P. E. Roshé in 1851. The first beginning towards the establishment of cement works in Russia had already been made. Towards the close of the reign of the Emperor Alexander I. during the twenties, a French engineer Raucourt de Charleville, in his time a known specialist on this branch of the building arts, and one of the first to realize in France the just elaborated methods and principles of Vica, was invited to Russia for the purpose of imparting information respecting hydraulic solutions, and for the investigation of Russian local materials suitable for the manufacture of cement. The then Chief Director of Ways of Communication in Russia, General A. M. Betancourt, nominated De Charleville, Professor of the Building Arts at the Institute of Ways of Communication, and at the time commissioned him to conduct researches in Russia, similar to those which he had already carried on in France. The vast work of De Charleville was printed in 1822 (*Traité sur l'art de faire de bons mortiers, et cetera: St-Petersbourg, imprimerie des voies de communication 1822, in 4^o, 362 p.*).

Among the Russian limestones investigated by De Charleville, were those of the town of Narva, where he constructed a bridge over the river Narova below the falls, and which is distinguished for its exceedingly rapid current. He also investigated the limestone of the shores of Lake Ladoga, where General Basen was then conducting large hydrotechnical works, and also the Tosna limestone which had a special interest in view of its importance for building purposes in St. Petersburg. The researches and experiments of De Charleville on the best methods of preparing hydraulic solutions from local limestones, were of great importance to civil engineering and were then and subsequently made use of, and their influence was partly seen thirty years later in the organization of a cement industry at the first Russian cement works established at St. Petersburg.

It became known that the Tosna limestone contains all the materials for the formation of a good hydraulic cement, and that even the common burnt lime from Tosna, used for simple mortars, evinces certain hydraulic properties. Colonel P. G. Roshé who was commissioned by the Government to investigate the limestones of the government of St. Petersburg, confirmed the statement that those layers of the Tosna limestones, which contain the most clay, are capable of giving a good hydraulic solution. These researches, which were based upon facts indicated by theory, were confirmed by actual experience. In 1851 Roshé started the erection of a cement factory on the banks of the Neva in the district of Schlüsselburg, 25 versts distant from St. Petersburg; and by successive experiments he elaborated a method for the manufacture of a good Roman cement from the Tosna limestone. In the sixties,

many buildings erected with the aid of this, the first Russian cement, gave proof of its satisfactory qualities, for instance, the tower of the St. Petersburg water works, which is, with all its submarine parts, 26 sagues high. The great advantage of this new cement was that it cost a third of the price of the English cement, it being from 16 to 20 kopecks per pound, while the English cost 60 kopecks.

In 1866 Roshé's works, which then had a production of about 200,000 pounds per annum, began to use the Volkhov limestone, from the banks of the river Volkhov, which contains from 16 to 25 per cent of argillaceous impurities, and which now remains the material used by the St. Petersburg cement works. The influence of Minard and Villeneuve's theory respecting the so-called basic carbonate of lime, which was accepted by the managers of Roshé's works, hindered the first Russian cement works from passing from the manufacture of Roman to Portland cement, and which was soon considered indispensable, upon the principle of not carrying on the roasting of the stone to softness. This peculiarity in the mode of manufacture at Roshé's works, which was not entirely satisfactory in regard to the quality of the material treated, was remarked somewhat later, in 1868, and explained by the researches of one of the best known specialists upon cements, Prof. A. R. Shouliachenko*, who subsequently founded the production of Portland cement from the same material in St. Petersburg. After Roshé's works which are still in existence under other proprietors and are known as the «Star Works», the oldest cement factory in Russia is the hydraulic lime concern of J. K. Pahl, which was erected in 1852, adjoining the lime kilns of the same proprietor in the Peterhov district, in the village of Zoborie. In the seventies these works produced up to 80,000 pounds (8,000 casks). At the present time they have stopped working.

Soon after the establishment of the first cement works in St. Petersburg, other similar enterprises were started in another locality on the border line of Russia, in the south-west frontier corner of Poland, where the Russian and the Austro-German boundary lines meet. In this region a small Roman cement works was first started in the government of Kelets in the Olekoushsk district at the village of Slavkovo. These works were erected by Mr. J. J. Tsekhanovsky in 1853. Four years later a somewhat larger Portland cement factory was erected in the government of Petrokovsk, in the village of Grodzetsy, where the manufacture was greatly facilitated by the fact that it could be carried on with the aid of the neighbouring coal. This was the first Portland cement factory in Russia; at first its production was limited, but towards the close of the sixties it rose to 250 to 275 thousand pounds a year, or 20 to 23 thousand twelve-pound casks; owing to the geographical position of the works, they not only supplied the local requirements, but also found a market in the neighbouring parts of Austria and Prussia, and up to the seventies the foreign sale formed their chief support**.

The present development of the Russian cement manufacture, begins with the erection of a cement factory on the Baltic sea frontier, at Podera near Riga, which was started upon the initiative of one of the most active industrial organizers of the

* See Jahresbericht für Chemie 1868, p. 939—940.

** Factors of the Russian Industrial Exhibition of 1870; St. Petersburg, Section II. Class 8. Guide book of the exhibition of 1870, p. 126. Class 8. № 34.

town of Riga, Mr. K. U. Schmidt. The researches of Prof. V. P. Liven of the Yuriev University, published in the «Archives of the Natural Sciences of Lithuania», upon the composition of cement-forming materials and the conditions of their hardening which preceded the erection of Mr. Schmidt's works, were begun in 1865, and these works were built by Prof. Liven in 1867. Very soon afterwards, the same learned chemist appeared as the constructor of another Baltic cement works at Port Kunda, near Vesenberg, half way between Narva and Reval. These works were started in 1870. Subsequently, in 1882, Prof. Liven erected the Black Sea Cement Factory at Novorossisk near the port of Novorossisk on the north-eastern side of the Black Sea. These works are the property of the Black Sea Cement Company. For further information respecting Novorossisk, see «Novorossisk, Its Shipping and Facilities, St. Petersburg, 1891.»

The wide scientific experience of Prof. Liven upon the manufacture of cement, is proved by the fact that at each of these three large works which he erected and organized, the quality of the Portland cement produced was equally good, although the local conditions and the materials used were totally different. At Riga the manufacture was at first founded upon the scanty local material, but it soon went over, as the production increased, to the employment of soft chalk imported from England. At Port Kunda the enterprise was based upon the abundance of excellent fresh water marls found in the neighbourhood, and which have now been worked for over twenty years. At Novorossisk a natural clay limestone is roasted, which is described in a paper by Mr. Stavitsky in the «Records of the Caucasian Section of the Technical Society», Vol. XVII, Number 5, which also contains the analyses made by Liven. These works, amongst which the Riga works, as the oldest, long stood first in the amount of its production, are still most important in Russia.

During the six or seven years interval between the foundation of these three works, several smaller Roman and Portland cement works were erected. Thus, the Roman cement factory at Kerch, on the Sea of Azov, were erected in 1868 by M. J. Cherkassov, and towards the seventies turned out about 4,000 casks, or 40 thousand pouds, with a plant of five cement kilns. Another cement factory was established in the Caucasus, in the government of Koutais near Poti, at about the same time, for the purpose of supplying the works of the port of Poti. These works treated hydraulic marls which were found, after some surveys made at the instigation of the Administration, by Mr. Bakhmetiev (Transactions of the Kiev Section of the Technical Society IV, 19) near the village of Teklat in the government of Koutais. These works, however, were soon closed, as the French Theil hydraulic lime was prepared for the Poti port works, although it was dearer. This Theil lime (Theil, canton de Viviers dép. de l'Ardèche) has been worked in the Lafarge quarry for centuries, and gives a hydraulic product which resists the action of sea water very well. The greater number of the ports of the south of France have been constructed with this lime. It was imported first to Poti and then to Batoum in very large quantities, until 1882, when the Novorossisk works were founded, and when the conditions for supplying the Black Sea ports with cements for submarine works entirely changed.

The Finnish factory «Savio» was built by Mr. Brummer in 1869, in the Neu-landsk government in the parish of Tusbio, about 2 to 3 miles by rail from Helsingfors, and it has made considerable progress in recent years. The works erected in

1870 by C. C. Rolov in the government of Kharkov, in the district of Valkovsk at the village of Starya Vodolaga, did not remain in action long. Emile Lipgardt & Co's works near Kolomna, at Schurovo on the Moscow-Riazan Railway, were established in 1875, and are now working. In the same year the Moscow «Podolsk» factory, near the station of Podolsk on the Moscow-Kursk Railway, were founded by Mr. Porokhovschik aided by Mr. Kouchera a chemist, and continued for four years without particular success. These works afterwards passed into the hands of the «Moscow Joint-Stock Company for the Manufacture of Cements and other Building Materials», and after being completely rebuilt, in 1887, began to work regularly, and now stand among the chief Russian cement works. Lastly, in 1877, the small Zdolbounovsk factory was erected at the station of Zdolbunovo on the Kiev-Brest Railway in the district of Ostrogozsk in the Government of Volynia by Mr. E. J. Elenek, an Austrian subject.

The last ten years 1883 to 1893 were noted for a particularly large growth in the production of the Russian cement works, which was further increased by the erection of two new centres of production, the «Vissoko Works» in Poland at Laza on the Warsaw Vienna Railway, founded in 1885, and the «Gloukhoozersk Factory» in St. Petersburg, where the results of Prof. Shouliachenko's vast scientific researches, were applied to the production of Portland cement with brilliant success. At the present time both these works belong to the number of the largest Portland cement works in Russia. Thus, there are now seven large Portland cement works in Russia, the Riga, Port Kunda, Novorossisk, Gloukhoozersk, Podolsk, Vissoko, and the Grodzetsk. To these may be added the smaller Schurov works of Lipgart and Co., which also manufacture Portland cement. Of the remaining factories above mentioned the following are now working: the St. Petersburg, Star Roman, of Roshé, the Finnish Savio, the Kerchensk Roman, and the Zdolbounovsk works in Volynia.

The majority of the Russian Portland works carry on, as is usual, the manufacture of artificial cement; that is to say, they prepare their fundamental clay and lime material by making an artificial mixture of the two component parts; moreover, they generally work after the wet method (grinding with water, stirring vats, large, settling vats, puddling before moulding in hand moulds, and drying stands). The St. Petersburg Gloukhoozersk Works carry on the mixing by the dry method (drying the material in drying chambers, dry grinding, sifting, making into a thick paste, and moulding in a brick machine). The Novorossisk factory operates upon a natural Portland cement produced by directly roasting a clay limestone, certain layers of which present a ready made natural mixture which entirely answers to all the requirements of Portland cement. Besides ordinary kilns working with coke, nearly all the factories possess Dietsch ordinary double ovens, in which the cement is roasted by means of coals. Some works, for instance the Podolsk, employ Hofman's circular ovens.

The grinding of the materials, and of the cement itself after roasting requires, as is known, the expenditure of a very considerable power, depending upon the mineralogical hardness of the limestone treated, and also partly upon that of the product after roasting. Of all the Russian Portland cement factories, that at Port Kunda treats the softest limestone, and works with engines having a total of about 300 horse power (two turbines and one steam engine, and another turbine of 150 horse

power is now being erected for enlarging the production). The other extreme is represented by the Moscow Podolsk works, which use a hard limestone and have 7 steam engines of a total of 900 horse power, although the output is slightly less than that of the Port Kunda factory. These data have been communicated by the chief director of the Podolsk works, Mr Ruhart. The large foreign manufactories, such as the Dekerhov on the Rhine, and the Allsen in the north of Germany, employ twice as much power. It may be said that altogether the eight existing Portland cement factories in Russia employ a motive power of not less than 2,500 horse power; out of these the Riga works have about 480 powers, so that the above-named three oldest works have together about 1,680 horse power. The amount of coal and coke annually consumed in the production of Portland cement at these factories is about 3,500,000 pounds. All the works have their own cooper shops, and the hoops for the casks sometimes form an object of rural industry in the same neighbourhood. The normal trade weight of a cask of cement is 11 pounds gross, and almost $10\frac{1}{2}$ pounds net, similar to the German cask of 170 to 175 kilograms. According to the latest official data the normal weight of a cask is somewhat less, between 164 and 168 kilogrammes*.

The present production of the Russian Portland cement factories in 1890 is given in the following table, which is compiled from data furnished by the works to the Meeting of the Cement Manufacturers in St. Petersburg, in February, 1892.

PORTLAND CEMENT.		PRODUCTION IN 1891.
		Casks.
1. The Vissoko in Poland		118,000
2. The Gloukhoosersk in St. Petersburg . .		117,000
3. The Grodzintsk		112,000
4. The Novorossisk		173,000
5. The Podolsk		95,000
6. The Port Kunda		120,000
7. The Riga		140,000
8. The Schurovo		45,000
Total . . .		920,000

According to the data for 1892 the production of these eight factories increased to one million casks, that is, over ten million pounds, or about 164,000 metric tons of Portland cement. The production for the present year may, from private information, be estimated at not less than eleven million pounds. It is also known from private sources that, in 1890, these eight works produced about 700,000 casks, or 7,000,000 pounds of Portland cement. The official statistics of the internal production do not separate

* Regulations and normals legal for the Russian cement industry, see besides Russian official sources, the protocol of the 15th general meeting of the German Portland Cement Work Union, from the 26th to the 27th February, 1892.

cements from burnt lime and alabaster. and therefore do not give a further insight into the gradual growth of the Russian cement production. The gradual increase of the output of Portland cement may be seen from the example of the most striking centres of its manufacture, the Riga and Novorossisk works.

The figures in the following table are taken from the accounts of the works, showing the production of the Riga cement factories.

Y E A R S.	PORTLAND CEMENT.	ROMAN CEMENT.	Y E A R S.	PORTLAND CEMENT.	ROMAN CEMENT.
	Barrels.			Barrels.	
1868.	1,743	2,000	1877.	64,597	6,187
1869.	3,825	2,110	1878.	55,200	22,740
1870.	8,674	2,010	1879.	81,931	24,716
1871.	16,280	9,380	1880.	84,072	20,848
1872.	27,510	19,380	1881.	84,931	22,427
1873.	28,851	27,530	1882.	97,742	21,250
1874.	39,929	6,625	1883.	111,780	28,000
1875.	56,650	2,489	1884.	128,643	—
1876.	56,252	19,953	1885.	134,079	—

The output of Portland cement from the Novorossisk Cement Works:

1883.	486,178 pouds.	1887.	1,418,618 pouds.
1884.	541,194 »	1888.	1,672,024 »
1885.	683,609 »	1889.	1,374,529 »
1886.	963,608 »	1890.	1,521,880 »

The production of Roman cement is carried on at certain of the above mentioned factories, and besides the three special Roman cement works beforementioned, at several other partially rural industries. Thus in 1891, the station of Podolsk on the Moscow-Kursk Railway dispatched 3,417 cars of Roman cement, 1,759 of which were from the Podolsk cement works of the Moscow Joint-Stock Company, and the remainder from eight other small works in the neighbourhood of Moscow. The production of Roman cement varies according to the market, to a somewhat considerable extent, as is seen from the preceding table on the output of the Riga works; and its relative yearly amount can only be given approximately at 300 to 450 thousand barrels for all the factories together.

Such a production as ten million pouds of Portland cement per annum is naturally small in comparison to that of those countries which have an export cement trade, such as Germany. The German production of Portland cement, which was established towards the middle of the sixties, increased with unwonted rapidity, and in 1878 reached to more than 2,500,000 barrels, or twice as much as the present Russian output; in 1886 the 48 works forming the «Union of the German Cement Works»

produced 5,500,000 barrels, or 926,000 tons; in 1890 over 9,000,000, and in 1892, 79 works produced almost 12,000,000 barrels of Portland cement, not counting Roman cement. With such a vast production in the adjacent countries, Russia cannot, naturally, count upon an export trade in its cement, all the more so as the climatic conditions, scarcity of capital and the feeble development of the home production of those machines which are indispensable in the manufacture, place it for the present under comparatively very unfavourable conditions for an external competition with the huge production of other countries.

The machine plant of the Russian cement works is for the greater part supplied by Nagel and Kemp in Hamburg, and Pallenberg in Mannheim. So long, however, as the production of the Russian cement works is only destined for the satisfaction of the home demands, facts show that its present amount of 10 to 11 million pounds of Portland cement, and about 3 million pounds of Roman cement, in all 13 to 14 million pounds per annum, very nearly approaches the limit which would satisfy the home demand, and entirely correspond to the scale of the present development of the building activity in Russia. The importation of foreign cement, which only lately had so important an influence on the home industry, now only plays a secondary role in the general supply of the country. The fall of the foreign importation, and the increase of the Russian production, are connected with the protective system of customs policy; but in this instance the connection is not so direct as in many other cases, partly because the amount of the protective duties in force until 1881 was insufficient, owing to the great difference between the cost of the Russian and foreign cements at the places of their manufacture. The first large Russian factory, besides the Grozdetsk, which was placed under special conditions of sale, as well as the Riga and Port Kunda works, were established at the time when foreign cement was still imported into Russia free of duty. In 1873, a duty of 3 kopecks paper was placed upon cement of all kinds, except that sent to the southern parts of the Black and Azov seas. In fixing this duty the State Council pronounced the following opinion: «That with the present competition of foreign cement manufacturers importing their product free of duty, not only is the further development of the Russian industry impeded, but the existing Russian works might at any time be obliged to close their doors, in the case of a temporary agreement between the foreign works to lower their prices. And if the Russian works ever cease working, they would scarcely be in a position to begin again, and the price of cement would increase irrevocably». (Imperially confirmed opinion of the State Council, 16th January, 1873).

From 1877 the duty formed, counting the exchange upon gold, on the average four and one-half kopecks paper per pound. In 1881 the duty upon cement, for all ports, was raised to 7 kopecks gold, and in 1885, to 9 kopecks gold per pound; and lastly, in the present tariff of 1891, the duty was placed at 10 kopecks per pound, with a view of further protecting certain special cases, such as the Polish works. Under the influence of the protective duty of 9 kopecks per pound, the output of the Russian factories has indeed recently undergone a very rapid increase, and at the present moment they are occupied in taking measures for further increasing their production; for instance, the Port Kunda works are now erecting the necessary plant for doubling their present yield of 150,000 barrels per year. They estimate their output in 1893 at 150,000 barrels, as against 120,000 in 1891. According to

information received from the St. Petersburg representatives of the Port Kunda works, the Riga factory of Schmidt and Co. estimates its production for 1893 at about 170,000 barrels. No builder will think it exaggerated to say that the manufacture and use of cement are connected, as an accessory to the building industry for which it forms an indispensable material, with the civil and political welfare of the country; and therefore, the considerable rise made in the duty upon imported cement could only be justifiable at a time like 1885, when it was evident, from the appearance of a sixth, seventh, and eighth Portland cement factory at Novorossisk, St. Petersburg, and in Poland respectively, that the industry would be firmly and ultimately established in the country. And this fact has not been long in being proved; at the present time, after a lapse of seven years, since the enforcement of the 9 kopecks protective duty, the country witnesses the full development of the Russian cement industry. According to official data respecting the production of lime, cement, and alabaster, it may be concluded that the production of cement in Russia in 1885 was 600,000 barrels, or almost half of the present output.

IMPORTATION OF CEMENT THROUGH ALL THE RUSSIAN FRONTIERS.

Y E A R S.	POUNDS.	VALUE IN ROUBLES.
1872	1,411,000	1,742,000
1873	1,898,000	1,335 000
1874	2,105,000	1,531,000
1875	2,629,000	1,602,000
1876	2,452,000	1,602,000
1877	1,485,000	767,000
1878	2,210,000	1,234,000
1879	3,027,000	1,440,000
1880	3,350,000	1,605,000
1881	2,006,000	1,293,000
1882	1,535,000	853,000
1883	2,977,000	1,003,000
1884	3,262,000	2,035,000
1885	2,865,000	1,546,000
1886	1,701,000	930,000
1887	1 827,000	948,000
1888	804,000	479,000
1889	891,000	568,000
1890	1,210,000	690,000
1891	1,058,000	534,000
1892	2,500,000	1,250,000 *

* Across the European frontiers only.

The importation of goods analogous to cement cannot in general present figures progressively increasing or decreasing with the course of years; therefore, it is very difficult to give a representation of the development of the internal production of the country to which this importation was directed. The independent Russian industry could only admit, in the calculations for its future growth, that amount of the demand for cement which could be regarded as the true average for several years; moreover, the character of the building season varies every year, and therefore the demand for cement is subject to considerable fluctuations, depending upon the variations of the work during the building season. In cases of an unexpected increase in the demand at a certain moment, the importation of foreign cement may appear in the quality of a balance for the Russian markets. And these somewhat sharp and accidental fluctuations reflect themselves on the figures of the imports, notwithstanding the successive growth of the internal Russian production. The preceding table gives the amount of the importation of cement, and almost exclusively of Portland cement, into Russia from 1872. Up to 1882 the statistics of the imports include lime, after which the cements are put separately from other building materials.

The total annual consumption of cements in Russia thus amounts to 14 million pounds of home manufacture, and taking the average for the last 7 years, about one and one-half million pounds of imported cement, altogether to the sum of nearly 7 million roubles paper.

The quality of the Russian Portland cement has long been recognized as equal to that of the best foreign makes, such as the English and the German. This can be stated now with firm conviction, since the testing and reception of the cement for Government works and private builders, has acquired its present state of per-

Y E A R S.	PORTLAND CEMENT IN BARRELS OF 10 $\frac{1}{2}$ POUNDS NET.	ROMAN CEMENT IN BAR- RELS OF 7 TO 7 $\frac{1}{4}$ POUNDS NET.
1868	5.50 roubles paper.	2.25 roubles paper.
1869	5 25 » »	2.25 » »
1870	4 00 » »	2.10 » »
1871	3.75 » »	1.80 » »
1872	4.00 » »	2.20 » »
1873	4.75 » »	2.50 » »
1874	4.50 » »	2.25 » »
1875	4.50 » »	1.80 » »
1876	4.75 » »	2.25 » »
1877	5.25 » »	2.25 » »
1878	5.75 » »	2.50 » »
1879	5.50 » »	2.50 » »
1880	5.25 » »	2.50 » »
1881	5.25 » »	2.50 » »
1882	5.25 » »	2.50 » »

tection, being carried on in the mechanical laboratory of the Institute of Civil Engineers of the Emperor Alexander I, under the direction of Prof. A. A. Belebubsky, whose scientific works and railway bridges are well known abroad. This laboratory has sent to the Columbian Exposition at Chicago a collection of data and specimens which cannot fail to interest foreign engineers, and will serve as a capital supplement to all that is already known by them, concerning the work done by this St. Petersburg Institute, and which is so important to Russia.

As regards the price of the Russian Portland and Roman cements, the following table, giving the prices of cement at the Riga works at various periods, may be taken as the normal for the internal production.

The average price for fourteen years is thus 4.85 roubles per barrel of Portland cement, and 2.26 roubles per barrel of Roman cement. At the present time the average prices remain approximately the same, or slightly lower; thus, in 1890 Portland cement cost 4.75 roubles per barrel, and Roman 1.85 per barrel of about 7 pounds; and in May, 1893, the price of Portland cement was 4.70 roubles; in the case of large orders a considerable deduction is made.

The average price of Portland cement per pound, including barrels, is thus 45 to 46 kopecks paper, or about 30 kopecks gold, which corresponds to about 60 shillings per English ton, or 73 francs per metric ton. On comparing these prices with those of foreign cements imported to Russia, and including the customs duty, it is found that the Russian cement works do not take advantage of the full difference of 9 or 10 kopecks, which is given by the customs duty upon the foreign article, but that they only appropriate a portion of this difference. This not unimportant circumstance indicates the growth in recent years of a considerable home competition between the Russian producers; and this again confirms the fact that the Russian cement industry has already, under the protective system of customs tariffs, obtained the desired development, and is now firmly established in all its independent branches.



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